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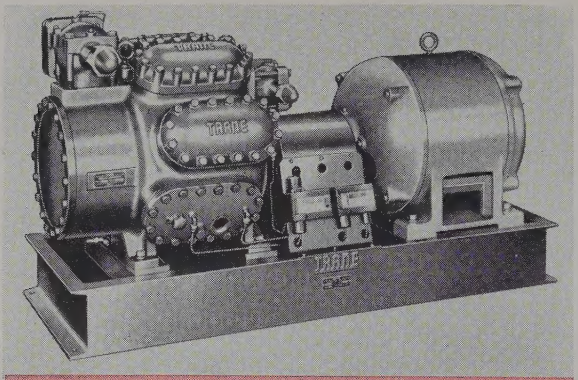

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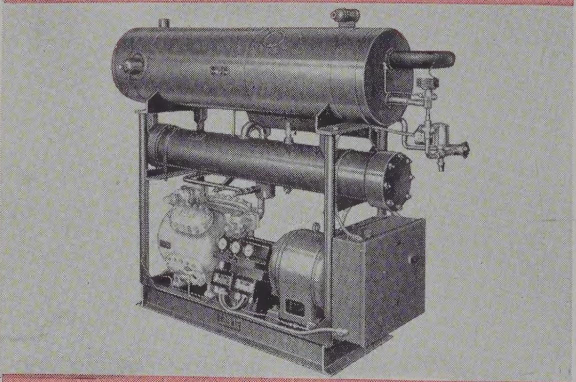

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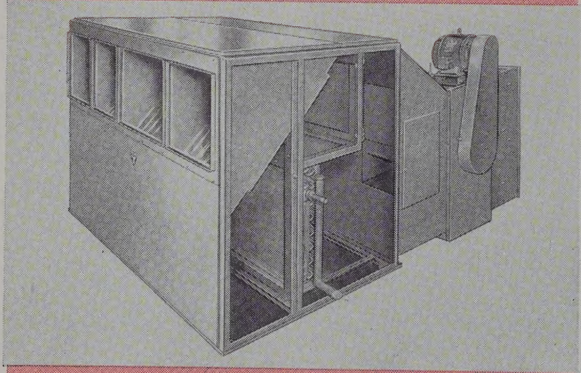

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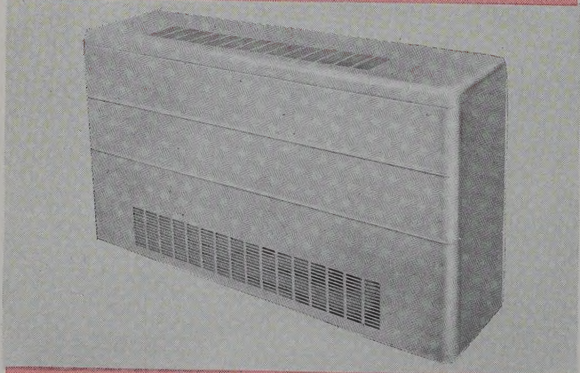

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RAIC JOURNAL

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The subway tracks looking towards Rosedale Station

Photograph by Canada Pictures Limited

ROYAL ARCHITECTURAL INSTITUTE OF CANADA

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EDITORIAL AND ADVERTISING OFFICES, 57 QUEEN STREET WEST, TORONTO 1

EDITORIAL

Toronto citizens of all ages and income groups are treating their subway like a small boy with his first electric train. We confess ourself to a feeling of pride of ownership, and of resentment against criticism even when justified. Criticism in the press is half apologetic and editors are patient and trusting. Bitter letters to the papers are few, and seem to be written by old country people who knew subways that were deeper, longer and older. Needless to say, the T.T.C. finds it unnecessary to argue with writers on any of these points. Our subway is not deep and, for most of its length, will soon be bright with spring flowers from the thousands of shrubs which line its banks; it is long enough for the first stretch in a future ambitious program, and as for age, it glories in its youthfulness.

We are a believer in young subways. As subways go, the Moscow metro has a certain youthfulness, but it is too bourgeois for our conservative tastes. Stories vary, but we should not be far wrong if we said the platforms were travertine, the walls were green Siberian malachite and the columns, lapis lazuli. For sheer extravagance, nothing equals the Moscow metro unless it is the streets of heaven. The T.T.C., unlike the Kremlin, is so secure in the affections of the people that it does not need to impress except by simple colourful surfaces, and handsome, comfortable, efficient trains. We are always impressed by the efficiency and speed of subway trains whether we are in London, Berlin, Paris, New York or Boston, but we have no pleasant memories of platforms or stations in those cities. In fact, one's memories are of dirty walls and horrid odours. We do not say so with any feeling of superiority because we remember that many of these underground railways were built fifty or more years ago. In 1900, beauty was not considered important in either the structures or the trains in our public or private transportation systems. One has only to recall Canadian or American railway stations with their T, G and V jointed ceilings, their benches designed with diabolical cunning to countervent the curves of the human body, their reddish brown paint and their peculiar nauseating odour. Subways of the period were equally sordid and, like the railway station, have their own peculiar smell. In Toronto, we have no odours unless it be those wafted into the stations from banks of forsythia. We write in April when the forsythia is in bloom, but soon it will be lilac followed in their season by weigela, japonica and verbena. Literally thousands of those beautiful shrubs are so arranged on the banks that the prevailing wind will carry their fragrance into the open stations.

Needless to say, stations and corridors are modern in design. We know nothing of the tastes of T.T.C. commissioners, but we suppose that even at the earliest stage of design, no goth would raise his voice, and even the classicists would be silent. The result need not be labelled. It is straightforward building with masses of simple brickwork and glass upstairs, and walls of coloured glass downstairs. The passenger of 1954 differs from his predecessor in 1904, or even 1914, in that he loves colour and hygenic surfaces. He, probably, demands more for his money visually and in matters of comfort and, over the years, has developed a greater pride in civic services and institutions. Such demands have been more than realized in the subway.

Readers of the *Journal* may question our sincerity or our sanity if we were to conclude this page without criticism. The T.T.C. itself seems to be aware of some errors of judgement that may prove costly to correct. Some stairs are narrow – so narrow as to make one wonder how such a mistake could occur, and more motorstairs (escalator, like frigidaire, is a trade name and ours are motorstairs) would speed traffic, and be a boon to the lame and the elderly. It is true that such a group is in a minority and the cost of more motorstairs would be somewhere in the neighbourhood of one and a half million dollars, but every decade the life span increases, and the elderly increase in numbers. Our own grossly unfair criticism of the subway strikes at the very notion of public transportation. We dislike being herded, we dislike humanity in the mass, and we particularly dislike being bumped in the rear by a turnstile device that, like humane killers, cries aloud for a Loewy to work a miracle of design. As one of the last living pedestrians, we have no reason to complain. Indeed, if we must be herded, and we see no possibility of obtaining a rapid transit system for our exclusive use, we would prefer to have it happen to us in Toronto.

The Toronto Subway

THE TORONTO TRANSIT COMMISSION, late successors to the Toronto Transportation Commission, have recently unveiled their most ambitious addition to the public transportation system. The several years of construction, with all the inconvenience entailed in the disruption of the main city artery, were all but forgotten as the local citizens, in a gay carnival spirit, went below ground to examine their new subway.

General Planning

Planning the Yonge Street subway started in 1942, when the Commission submitted to the Mayor and Board of Control a proposal for the construction of a rapid transit system in Toronto as a partial solution to Toronto's growing traffic problem.

At that time, the population of Metropolitan Toronto was about 925,000. The city of Toronto itself contained about three-quarters of this metropolitan population and occupied an area of 35 square miles.

It is not, however, the population of a city that governs the need for rapid transit service, but the location and character of its streets, and the concentration and congestion of its traffic and business activities. Present day traffic congestion has developed from the pouring into narrow streets, designed for horse-drawn traffic, the ever growing volume of passenger and commercial motor vehicles.

The Toronto Transportation Commission's proposal drew attention to the ever-increasing difficulty of maintaining regularity of service and reasonable speed for transit vehicles operating through narrow streets congested with automotive traffic. It advocated separation of street car and automobile traffic on two major routes by the construction of:—

(a) One north and south subway in the vicinity of Yonge Street, extending from Front Street to St. Clair Avenue.

(b) One east and west subway in the vicinity of Queen Street, extending from Trinity Park in the west to just east of Broadview Avenue in the east.

In 1943, the Commission established a new department and appointed the present Chief Engineer, Mr W. H. Paterson, as Engineer of Rapid Transit. Mr N. D. Wilson of Toronto and DeLeuw Cather and Company of Chicago were retained as consulting engineers to assist in invesigating the requirements and planning for the construction of the nucleus of the subway system. At a later date, the Commission retained Messrs J. B. Parkin and A. S. Mathers to advise on architectural problems and Dr R. F. Legget to advise on sub-soils.

With minor exceptions, the entire work of designing and supervising the construction of the Rapid Transit System, in all its various phases, was carried out by the Commission's own staff engineers and architects who were assisted by DeLeuw Cathers' resident engineer and occasional conferences with the other consultants.

The original proposals had been predicated on the operation of surface type street cars through subways which would, however, be designed to accommodate larger rapid transit cars as a later development.

Estimates of probable traffic in the Yonge Street and Queen Street subways were made, based on anticipated post-war conditions, prospective increases in population in the areas served, changes in traffic demands due to transfers from parallel routes, and traffic induced by the more rapid and more convenient service afforded by off-street operation. These estimates indicated a total one-way movement, during the maximum periods, of about 20,000 passengers per hour on the Yonge Street subway, and from 8,000 to 9,000 passengers per hour on the Queen Street subway.

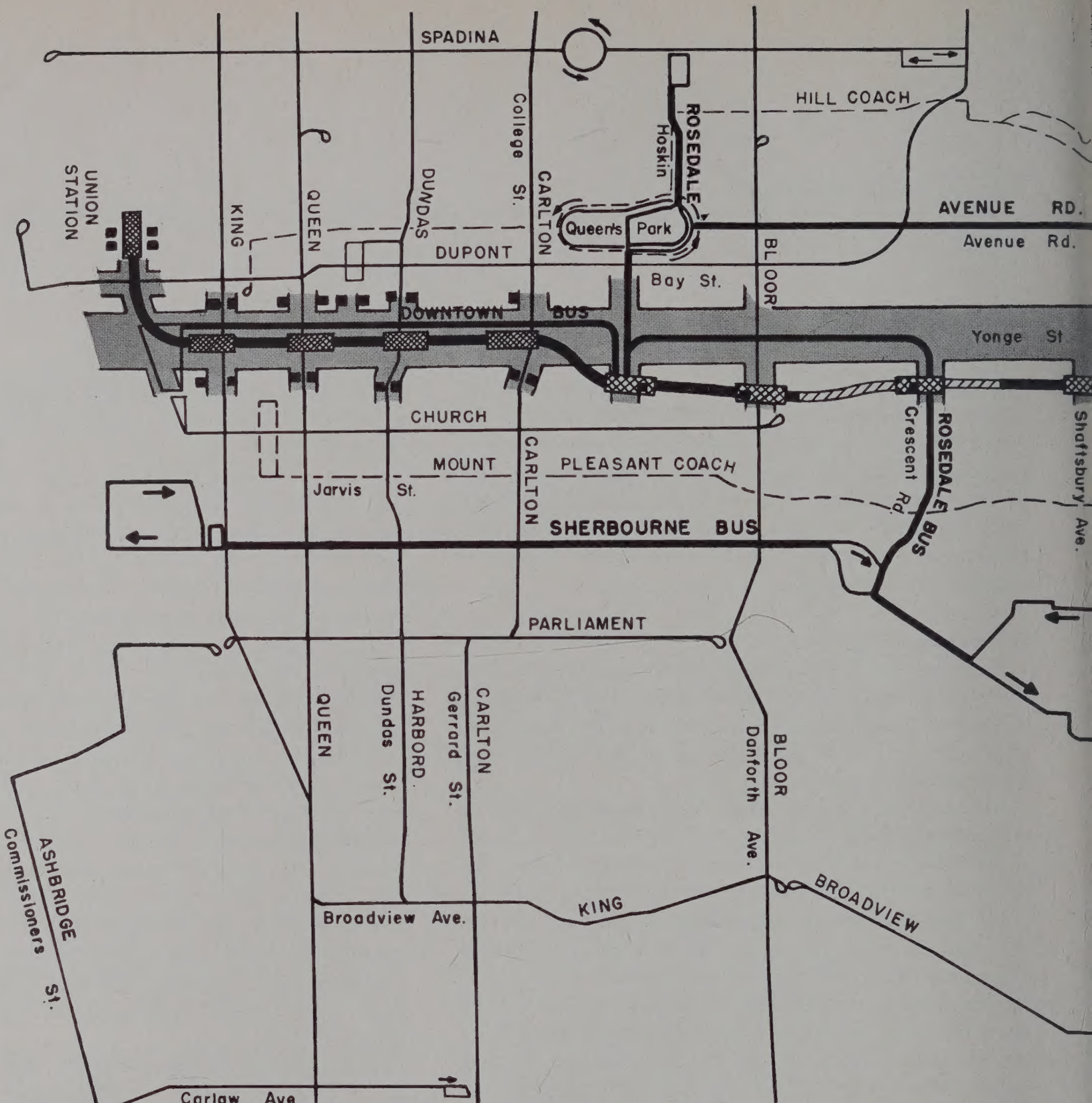
It was evident that speeds in the Yonge Street subway, if operated by street cars, would provide but limited improvement in running time over the surface street cars. It was further evident that the capacity of the subway with surface car operation would be taxed from the first day of its operation. It was decided therefore to consider the relative advantages of building the Yonge Street subway for immediate rapid transit operation. The studies showed:—

1 That the Yonge Street subway should be extended north from St. Clair Avenue to a terminal at Eglinton Avenue.

2 That the capacity of the subway, by using modern rapid transit trains, would be three times the capacity of street car operation.

3 That cars could be much wider than surface cars, providing more comfortable seating and a greater capacity. In addition, they could be constructed without steps and with a uniform clearance from the platform at all points of the car, thus minimizing accident hazards.

4 High level platforms could be located closer to the street surface, increasing the convenience to passen-



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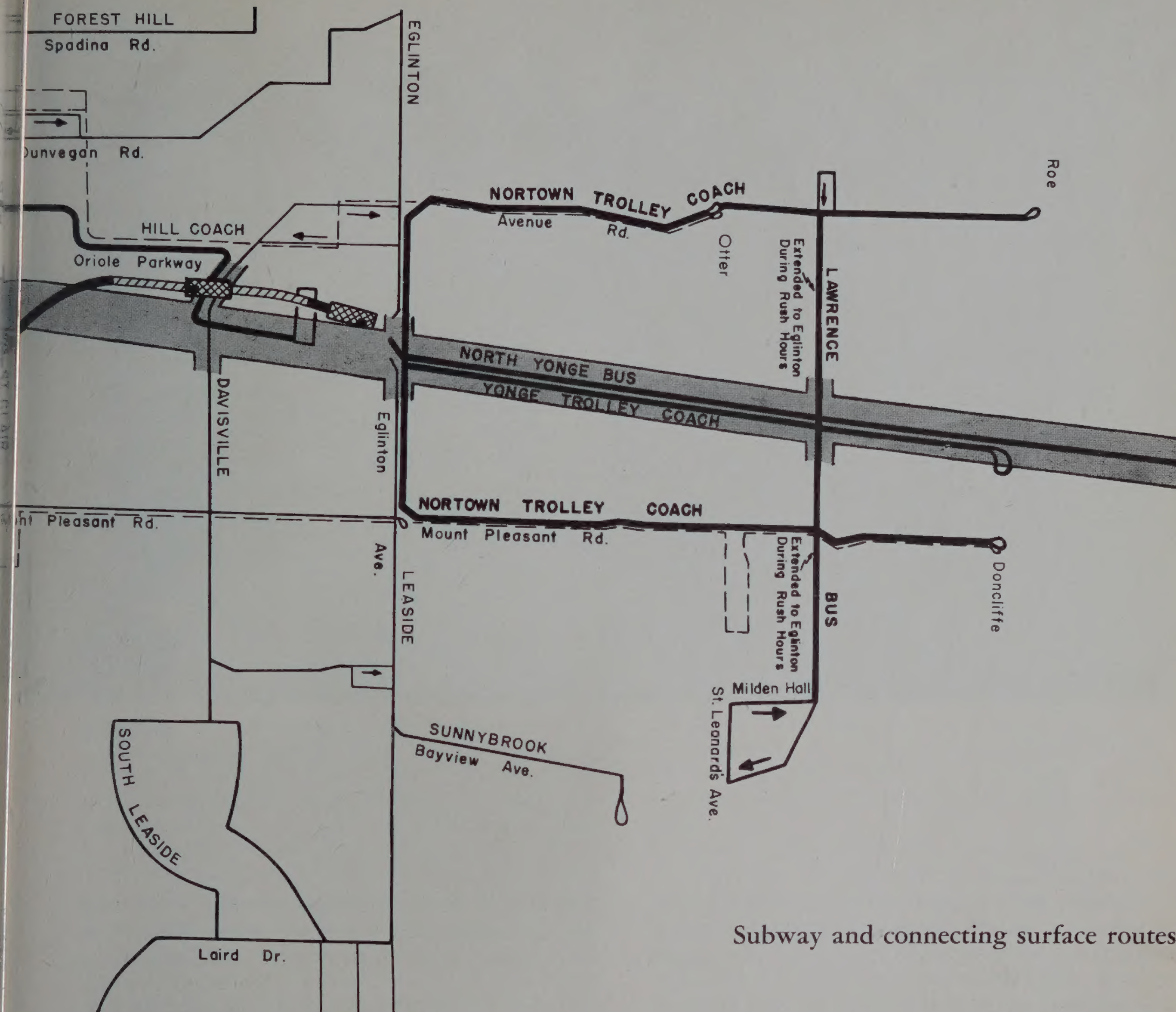

Subway and connecting surface routes

gers and the loading and unloading of the cars with maximum speed because the platform and car floors would be at the same level.

5 Subways could be operated by trains or rapid transit cars, permitting minimum station stops, greater spacing of trains and higher speeds.

6 Service would be wholly free from street traffic delays and inclement weather conditions to which surface cars are subject.

In a joint report submitted by Mr Wilson and DeLeuw Cather and Company, on April 1st, 1944, the construction of a subway to provide full rapid transit operation on Yonge Street between Union Station on Front Street and Eglinton Avenue was recommended, and the Commission, after full consideration of all the factors, authorized development of plans for this subway, based on the provision of third rail rapid transit train operation.

The final route for this subway is as follows:

From Union Station in subway under Front Street and under Yonge Street to Carlton Street; then swinging eastward onto a private right-of-way about 150 feet east of Yonge Street and continuing northward in subway to a point north of Davenport Road; then emerging to open-cut on private right-of-way through Rosedale; thence in subway under the C.P.R. at North Toronto Station; in open-cut to St. Clair Avenue; in subway from St. Clair Avenue to Heath Street, swinging across under Yonge Street to the west side, emerging in open-cut north of the old Belt Line Railway and continuing on the west side of Yonge Street to Berwick Avenue with an underground terminal between Berwick Avenue and Eglinton Avenue.

The total length of the Yonge Street subway is 4.56 miles of which 3.20 miles are in subway construction and 1.36 miles in open-cut.

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Car interior

Alignment and Grade

Generally, the alignment follows long tangents with easy curves, spiralled according to standard American railroad engineering practice. There is one short radius curve, 400 feet, at Front and Yonge Street. The final alignment was not adopted until many trial lines had been established to reduce to a minimum the number of curves required. Although Yonge Street appears to be straight, it was necessary to make a slight deflection in the line north of Dundas Street. North of College there are two reverse curves with a short tangent between, where the alignment swings off Yonge Street to the private right-of-way but from there the line is a tangent to Bloor Street. North of Bloor, the line curves to avoid the Bell Telephone Co. Bldg., and from there runs generally straight to St. Clair Avenue.

In the vicinity of St. Clair Avenue the problem of alignment was more complex than in any other section of the route. A cemetery on the west side of Yonge Street south of St. Clair Avenue prohibited swinging to the west side of Yonge, and a cemetery on the east side of Yonge just north of Heath Street had a similar effect. It was therefore necessary to cross from the east to west side of Yonge Street in the limited area between St. Clair Avenue and Glen Elm Avenue.

To further restrict the area in which the transition could be made there is located in the block between Heath and Glen Elm, the Yorkminster Baptist Church, a very large masonry structure. Another church, also a masonry structure, is located directly opposite on the west side of Yonge Street. As masonry structures are most difficult to underpin, it was desirable to avoid any disturbance to the foundations of these two churches.

The block between Heath and St. Clair Avenue is well built up and any reasonable alignment encountered an apartment building, two theatres and substantial business structures on St. Clair Avenue.

The alignment finally adopted introduced a curve south of St. Clair Avenue, with the St. Clair Station on a tangent which extended underneath the buildings between St. Clair and Heath Street, including the two theatres and the apartment building, crossing Yonge Street diagonally between the two churches but well clear of their foundations, and continuing north on the west side of Yonge Street.

The maximum gradient in the subway is 3.5 per cent, which occurs south of St. Clair Avenue, where the subway must climb the escarpment. (The existing grade on Yonge Street at this location is 6.5%). For operating reasons, particularly, the track was kept as close to the surface as possible. Over one-half of the passengers will transfer to surface lines and to make this transfer as rapid and convenient as possible, it was highly desirable to keep the platforms close to the surface.

Job Control

THE YONGE STREET SUBWAY was scheduled for completion of structures by the end of 1953. The work has been completed generally in accordance with this schedule as a result of careful scheduling of work and the willing co-operation of contractors, governmental and other authorities, companies, utilities affected, and suppliers of materials and equipment.

Co-operation, which is the key work in the story of job control, was sought by the Commission when the project was first contemplated. When problems of location were still at the discussion stage the Commission's proposals were informally discussed with officials of the city, Toronto Harbour Commissioners, Toronto Traffic Conference, Toronto Terminals Railway, etc.

One of the early meetings called to discuss the project was a special meeting of the Public Utilities Co-ordinating Committee. This committee (referred to as the P.U.C.C.) is made up of representatives of the roadway, sewer, bridge and waterworks sections of the Works Department of the City of Toronto, the Bell Telephone Company, the Consumers Gas Company, the Toronto Hydro-Electric System, and the Toronto Transportation Commission.

The committee prepares drawings showing the location of the various utilities occupying the streets and the cost of making these drawings is shared equally by the members.

The committee meets under the chairmanship of the Deputy Commissioner of Works and at these meetings many problems regarding the occupation of streets are resolved. It was, therefore, most important to the Commission that this committee be advised at a very early date of the Commission's plans for a subway on Yonge Street.

At this meeting and continuously thereafter, the Commission received the full support and cooperation of this committee and the organizations represented.

Plans

While the Commission was developing plans for the subway, the City of Toronto Planning Board was actively engaged in preparing a master plan for the city. Through the cooperation of the Planning Board, arrangements were made for representatives of the Commission to attend such meetings as were necessary to make sure that the Commission's plans for improvement of services would not be in conflict with improvements proposed by the Planning Board.

Specifications

Before undertaking the writing of the specifications for this project, specifications written for many other similar projects were examined. It was the Commission's desire that subway structures be built in accordance with the highest accepted standards and at reasonable cost. The specifications were written therefore with the intention of giving complete and accurate information regarding the design of structures to the tendering contractors, but leaving the contractor free to use his ingenuity with regard to construction methods.

In this regard, when the first set of contract drawings was completed, but before the project was scheduled for construction, most of the major Canadian contractors in the heavy construction field were invited to review the Commission's plans and specifications and discuss them with the Commission's engineers.

Supply of Critical Materials

During the post war years, many materials essential to subway construction were in short supply and many critical materials were available with Government approval only.

Because subway construction would disrupt traffic in the downtown area, it could not be undertaken until material became available in the necessary quantities to maintain all contracts on schedule. The timing of subway construction was therefore discussed with the proper authorities at Ottawa, and it was not until their assurance of cooperation was obtained that the first structural contracts were advertised for tender. The subway was never given priority classification by Ottawa but every reasonable assistance was given the Commission at all times in the procurement of critical materials.

Before advertising the first structural contracts the Commission purchased 8,000 tons of structural steel required for the falsework and shoring. This avoided the delay in starting work which would have occurred if the contractor had placed the order after procuring the contract.

Similarly on structural contracts S-3, S-4 and S-5, sufficient steel for falsework and shoring to get the job started was purchased from European sources before these contracts were released for tender.

As the job progressed, material, particularly steel, instead of becoming easier to procure as anticipated, became much more difficult to obtain. Fortunately the contractor on contracts S-1 and S-2 had placed all orders for steel promptly and through his own efforts procured the necessary steel to complete his contract.

As the work progressed on other contracts a shortage of reinforcing steel developed and to avoid delay on this

account, the Commission purchased substantial tonnages of steel from Europe and the United Kingdom. This steel was purchased at a price much in excess of the controlled Canadian prices, and was made available to contractors to make up shortages in their Canadian deliveries at Canadian prices.

In order to reduce the quantity of reinforcing steel required to complete the subway structures, some structures such as retaining walls were re-designed to increase the volume of concrete and reduce the amount of reinforcing steel required.

To avoid delay in completion of the entire project on account of shortages in items other than steel, a very comprehensive quantity of critical materials and equipment was purchased by the Commission and furnished to the contractors. Some of these items purchased and supplied by the Commission are as follows:

Brick
Cables
Insulated wire
Conduit
Electrical outlets
Supervisory equipment
Switchboards
Telephone equipment
Light fixtures
D.C. breakers
Pumps
Louvres and fans
Plumbing fixtures
Cast iron pipe and fittings
Wrought iron pipe and fittings
Brass pipe
Fire equipment
Boilers and heating equipment
Shop equipment
Tile pipe
Reinforced concrete pipe
Corrugated sheet metal pipe
Hardware
Plumbing equipment
Partition tile

It might be of interest to mention that the storage of this material presented another problem which was handled by the stores section of the Commission's Treasurer's Department, which extended the existing storage areas and took over an abandoned substation to provide storage for some of this material.

Construction Schedules

At the time of undertaking the first contract, a comprehensive schedule for all contracts of the entire project was established showing date for completion of plans and specifications, date of advertising for tenders, date of commencement of work and the date of completion of work. This schedule was, of course, a general control only and each contract had its own schedule for its various phases. Of these probably the most complex were the heavy construction contracts in the downtown section where almost every operation affected the downtown merchants and their customers.

Before the contractor could commence excavation on Yonge Street, the car tracks had to be removed. To permit their removal, it was necessary to divert the Yonge cars to another street and for this purpose a series of diversions using Church and Victoria Streets for north-south operation, and various east-west streets were devised.

After the contractor had completed the first phase of his excavation and had replaced the timber deck, the street cars were restored to Yonge Street. To permit removal of the timber deck and backfilling of the street, it was necessary to again divert the Yonge traffic to the diversion routes.

These diversions were not made until they had been carefully studied by the operating departments and brought to the attention of the Toronto Traffic Conference which is made up of representatives from the following:

Toronto Board of Trade
Downtown Businessmen's Association
Ontario Motor League
Ontario Safety League
City Police Department
Toronto Transportation Commission
City Traffic Engineer
City Works Committee.

By bringing the proposed diversions to the attention of the conference, those most concerned were aware of the Commission's intentions. Although it was not possible to satisfy every requirement, a sincere and genuine effort was made by the Commission to avoid undue interruption to the street, and to provide service when it was essential. For example, no traffic diversions on Yonge Street were permitted during the month of December on account of Christmas shopping. No traffic diversions were permitted on Front Street in the week before Christmas or Easter on account of heavy traffic at the Union Station. Long diversions were avoided during January and February on account of the difficulty of travelling during the winter months.

After the plan of a diversion has been developed and reviewed by the Toronto Traffic Conference, it was then taken up with officials of the city departments affected – i.e. Police, Traffic and Fire. After obtaining these approvals the diversion was then advertised in the daily newspapers.

As well as diverting street car traffic, it was necessary to arrange alternate routes for the free-wheel traffic that normally used Yonge Street. These alternate routes were jointly planned by the Commission's Director of Development and Research and the City Traffic Engineer and were included in the diversion plans.

Maintenance and Restoration of Utilities

The maintenance and restoration of utilities during the construction of the subway was probably one of the most important requirements of job control. It was known that subway excavation would dislocate sewers, watermains, gas mains, Bell Telephone cables, Hydro cables, C.P.R. and C.N.R. Telegraph services and the services of the Dominion Electric Protection Company. Through the Public Utilities Co-ordinating Committee, many discussions were held on methods of maintaining and restoring

the various services. However, the plans showing the restored location of utilities were made by the staff of the Commission but approved by the members of the P.U.C.C.

To permit work to proceed without delay, the Commission negotiated with each utility company, an agreement which set out those operations for which the Commission or its contractor would be responsible, and the method of payment. As a result of this cooperative planning and careful work on the part of the contractor, consumer complaints were practically negligible, although a slight mistake could have resulted in cutting of cables and leaving the downtown area without electric power or communication.

Testing and Inspection

The procurement of wide variety of materials for the project presented a problem in inspection and testing. Certain testing procedures were already established in the T.T.C. but it was decided to set up a separate Test and Inspection Section of the Rapid Transit Department.

A survey showed materials and equipment would be coming from coast to coast of North America, and from Europe and Great Britain. As there are a number of commercial inspection companies who maintain inspection services in principal industrial areas, the Commission called for tenders for inspection and testing of specified items. In this way inspection was assured when needed of such items as cement, steel, cast iron pipe, concrete pipe, vitreous pipe, rail and special work, etc.

All concrete in the subway structure was supplied contractors from "Ready-Mix" plants. The cement, aggregates and mixes were all supplied to T.T.C. specifications. Continuous batching plant inspection and testing was maintained by commercial service under the overall supervision of the Rapid Transit inspectors.

In addition to this, on-the-job-inspections took some 6,100 concrete test cylinders.

Where possible, materials were specified to Canadian Engineering Standards Association, British Standards Specifications, American Society for Test Materials standards.

An example of the diversity of inspection services is found in reinforcing steel. That material was made in Canada to C.E.S.A. specifications, in the United States to A.S.T.M. code and in Great Britain and Luxembourg to B.S.S. In each case our commercial testing service supplied certificates of inspection at the various mills.

Mechanical equipment such as pumps, fans, etc. were inspected and tested at the factories by the Rapid Transit Testing Section. This Testing Section also undertook to evaluate tests on paint suitable for an underground structure. Since conditions were more severe than found in most places in the country, a series of special tests were carried out to complement the specifications submitted by reputable paint makers.

Assistance by National Research Council

Throughout the entire project the Building Construction Branch of the National Research Council kept in close touch with the project, and for two years furnished a full time engineer to make observations of job conditions and conduct certain tests. The assistance given the Commission by the National Research Council on the project was of great value to the Commission and the result of observations such as sub-soil conditions and behaviour of false work under load will be of value to both owners and contractors on future construction projects.

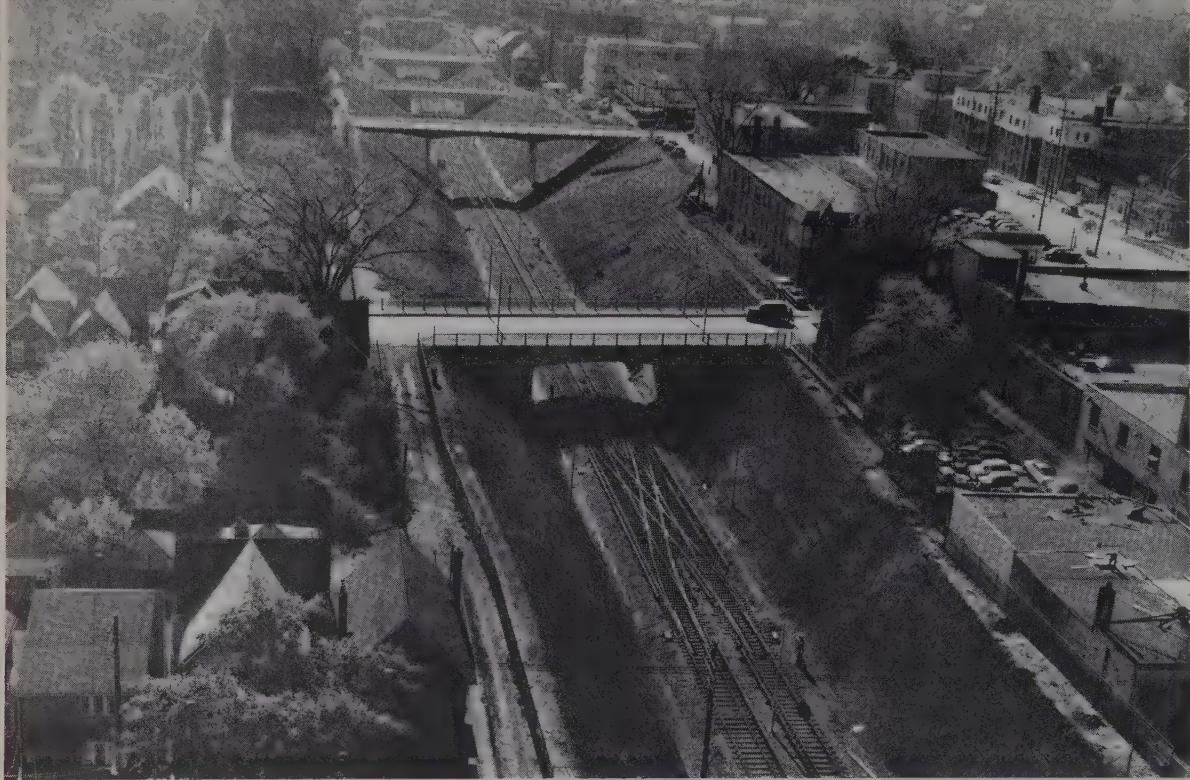
Records and Estimates

The Records and Estimates section was formed to keep records of the progress reported by the field staff, calculate the amount of work completed, prepare monthly statements for payment, and estimate the cost of any modifications to the original contracts. The contracts were written on the basis of an approximate bill of quantities against which the contractors submitted unit prices for each item; that is, a price for a cubic yard of excavation, or of concrete, or for a pound of structural steel, and so on, installed in place according to the contract drawings. Therefore a detailed and comprehensive record of all the construction work, providing a factual report of progress and expenditures, was required.

Questions on contract terms, affecting payments, were referred to this section. Useful modifications, frequently required by material shortages, were developed by the contractor's and Commission's staffs. Therefore, in addition to maintaining records this section had the responsibility for supervising payment on account of changes, setting rates on new items, and applying the control terms as required by these modifications.

From the records of this section final settlements of contracts are made. The first contract closed out shows variations between estimated and final quantities varying from -9.0% to 1.6%.

This small variation between estimated and final quantities reflects the value of job control which has been in effect throughout the life of the project.



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Looking south from Pleasant Boulevard

Architectural Design and Finish

Arthur G. Keith

THE ARCHITECTURAL APPROACH to the subway station design problem was based on the desire to create a useful series of structures, each suitable for its own purpose and location, yet co-ordinated to produce a related design throughout.

The relatively narrow city streets restricted the areas available for the downtown stations and required extensive planning adjustments in resolving the conflict between the desirable and the possible.

Through the generous co-operation of the design and operating personnel of other subways, their years of experience were readily available. Some of the features of other transportation systems were adapted for use in the Toronto subway.

Planning of Stations

Early studies of route alignment and station locations established five underground and seven above ground stations. Of the latter, six required controlled transfer facilities for connecting surface bus and/or street car lines.

The underground stations were located at existing surface line transfer points and the sidewalk entrances were located on the transverse streets. Discussions with the city authorities and with the adjacent property owners established the general form and sidewalk location of the entrances. It was found that the general public and the subway patrons would be best served if the entrances were located adjacent to the curb line and not less than 50 feet from the street corner. The surface entrance together with the necessary clearance at the curb occupies almost seven feet of the normal twelve foot sidewalks. Underground passageways connect the four station entrances to the control area.

The control area for the underground station was located at an intermediate level between the street and platform where the grade permitted. Elsewhere the control area was placed at platform level. The control areas were designed to channel the flow of incoming and outgoing passengers through the turnstiles which, together with the barrier railings, gates, and ticket booth, separate the public area from the paid area. Service rooms such as switchboard, battery, cleaners rooms and staff lavatories as well as public telephones, parcel lockers and concessions were located in the control area.

Stairways, supplemented in some locations by escalators, connect the mezzanine areas and the platform. The twelve foot wide platforms are five hundred feet long and will accommodate the maximum length train. The platforms are of the high level type approximately matching the floor level of the cars. At the terminal stations the platforms are located in the centre of the structure. Elsewhere side platforms have been used.

The superstructure of the above ground stations contains the control area facilities and provides connections

to the subway platforms as well as the surface bus or street car lines.

At several of the underground stations agreements were made with adjacent property owners for the construction of off-street entrances in lieu of the sidewalk type. In most instances these entrances will be available to the public for the entire daily operating period.

Models

During the preliminary design stage extensive use was made of both scale and full size models to study requirements and to keep vitally interested non-technical personnel informed of the design trend. Studies of materials and traffic flow were made with the assistance of full size models of a control area complete with ticket booth, barrier railings and turnstiles.

Materials

The selection of materials for use in the public areas of the subway was made after extensive research. Competent observers reported on the practice and experience of comparable subway structures not only in North America but in Great Britain and continental Europe as well.

In addition to the usual public building material characteristics of appearance, ease of maintenance and cost, consideration was given to the requirements of moisture resistance. Such subterranean structures are inherently damp due in part to moisture penetration of the envelope, but mainly due to condensation on the relatively cold surfaces.

The floors and base in all enclosed public areas are terrazzo. The terrazzo was laid with a white cement matrix, containing an abrasive material and divided with heavy-top zinc strips. White abrasive tiles were used on the stair treads and on the platform edge. In out-door public areas a patented non-metallic cement floor topping was substituted for the terrazzo. The cement floor finish was also used in all service rooms except the battery rooms which were surfaced with mastic.

The interior wall finish in public areas is a composite material of coloured opaque glass bonded to a concrete backing. Where used as a surfacing for the structural concrete walls an air space has been left between the finish and the structure. The walls of the service rooms are exposed structural concrete or smooth faced hollow tile.

The ceilings of the control areas are suspended perforated cement asbestos panels backed up with an impregnated acoustic board. Elsewhere the ceilings are painted concrete. In the control areas of the above ground stations a limited quantity of acoustic plaster and pre-cast acoustic tile has been installed.

The superstructure of the above ground stations is constructed with semi-glazed brick bearing walls, supplemented with concrete or structural steel columns. In most cases the roof framing is reinforced concrete. In keeping with the open planning used throughout, extensive use has been made of insulated double glazing and glass doors. Corrugated glass and glass block have been used in the street car and bus shelters. The sash trim is extruded anodized aluminum.

The interior door frames in public areas are fabricated from stainless steel and are of the hospital type. The doors for these openings are plastic faced slab doors with a patented inner steel frame. In service rooms, cold rolled steel was substituted for the stainless steel and the plastic facing was omitted from the doors. The door hardware is the key in knob type fabricated from nickel silver.

The special open type telephone booths have an interior surfacing of perforated rigidized stainless steel over the acoustic material. The counters are plastic faced and the trim throughout is stainless steel.

The illumination of the structures is by fluorescent lights recessed into acoustic ceilings or surface mounted on the concrete. At platform level the fixtures have been mounted end to end to give a continuous ribbon of light over the platform edge. The fluorescent lights have been supplemented with a battery powered incandescent emergency system which will provide satisfactory illumination if the Hydro source is temporarily interrupted.

The fixtures, which were designed specifically for the subway, are of the dust tight single tube type. The majority have extruded aluminum bodies, cast aluminum end plates and sagged ribbed opal glass with coated aluminum reflectors. The public area lighting system has been designed for a minimum of seven foot candles increasing to twelve foot candles at stairways.

Supplementing the acoustic treatment of the control areas is an installation at track level. Beneath the platform lip at stations and on the centre wall between stations, acoustic panels have been installed. An appreciable reduction in the noise intensity is anticipated.

A total of four 48-inch and nine 32-inch wide escalators or "motorstairs" have been located at strategic locations throughout the subway. While these machines are of the reversible type it is expected that they will normally operate for the up movement only. Stainless steel and aluminum have been used extensively for the trim work on these machines.

Colour

An attempt was made to enhance the appearance of the stations through the use of colour. The glass wall surfacing was fabricated in light shades of yellow, green and grey. At platform level a colour band was installed at the junction of wall and ceiling. The four band colours selected were black and dark shades of red, green and blue. Thus twelve wall and band colour combinations were available for the twelve stations. The colour selected for the band at each station was repeated in the painting of all exposed structural steel columns.

The terrazzo floors and painted ceilings are slightly tinted monochromatically with the wall surfacing.

Signs

Illuminated signs have been used sparingly throughout the subway — on the theory that the more signs the less important each becomes. Illuminated signs have been installed to indicate important directional instructions only. Elsewhere signs have been sand blasted and painted on the wall surface. The station name appears in 4 inch letters at 16 foot intervals in the colour band at platform level. These identifying signs are supplemented by 10

inch signs at approximately 80 foot intervals. Experience has shown that for new uses of the subway considerably more signs are required. These are being added to the system as soon as the need is evident.

Route maps have been installed in the control areas and at platform level.

Control Equipment

Ticket booths are located in each of the control areas. Depending on the anticipated traffic requirements the booths are designed for one or two man operation. To assist the agents in handling the peak loads, token vending machines are installed in the public area and the turnstiles will accept the tokens in payment of the fare.

Gates installed in the barrier railings permit the rapid collection of transfers at downtown stations.

Transfer issuing and validating machines are located in the paid area. Thus passengers making multiple transfers from the subway to surface lines obtain their transfers themselves without waiting in line to be served by the station cashier.

Concessions

Limited concession facilities have been included in the subway features. The advertising concession establishes a limited quantity of top quality advertising at platform level. Stainless steel frames secured to the structural columns permit the use of shallow three dimensional displays.

Where warranted by anticipated traffic, concessions have been established to handle candy, cigarettes, newspapers and magazines. In addition, coin operated parcel lockers have been installed.

Selection of Paint

Examination of the finish painting on the concrete surfaces of other subway systems revealed an almost universal problem in maintaining protective and decorative paint surfaces in a satisfactory condition. In addition to the normal breakdown of the paint film through oxidization, it was found that the surfaces failed due to lack of adhesion to the concrete, abrasion, mildew. In addition some surfaces had a great affinity for dust and dirt.

Due to the size of the overall project, the Commission had an opportunity to test a variety of paints in situ for a period of sixteen months. A section of the structure was selected for the experiment. To reduce the residual form oil to a minimum, one half of the ceiling surface was given a sand-water blast treatment while the balance was rubbed with wire brush and water or solvent.

The paint suppliers were advised through trade journals and approximately sixty manufacturers participated in the tests. Prior to formulating their paints, the suppliers were advised as to the general conditions in the structure and had an opportunity to examine the site.

Well over one hundred samples were applied by the same crew of painters working under the general direction of the manufacturers' representative. Coverage in single or double coat, ease and rate of application were recorded. Shortly afterwards light reflectance tests were taken.

The conditions during the test were more severe than should be experienced during operations. Temperature and humidity conditions, which were checked daily, showed a temperature range from 35° to 55° and a humidity range from 50% to 100%. In addition the area was used as a trucking lane and the ceiling surfaces were subjected to gasoline and oil fumes as well as the abrasive action of air-borne solids.

After six months of exposure about 20% of the samples showed signs of failure in adhesion due to flaking or blistering and an additional 10% were discoloured. The proportion of failures increased to approximately 90% after sixteen months.

The remaining samples were checked for light reflectance and ease of cleaning. Tenders were requested from twelve manufacturers for the bulk supply of paint of a quality equal to their previously submitted samples.

While the detailed formulation of the twelve paints was not revealed, it is interesting to note that the majority were of the "rubber base" type, two of which were identical to that supplied through the retail trade for home application.

Since no apparent advantage was gained by the relatively expensive wet sand blast treatment, the surface preparation was limited to dry brushing and the removal of serious stains by the application of a solvent.

The chlorinated rubber paint, which was selected, not only had the best test record but also proved to be the most economical. It was tinted monochromatically with the station wall surfaces and a single coat was applied by brush.

PANDA

Davisville transfer bus platform

Davisville bus transfer shelter

PANDA

Davisville interior

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Davisville platform and tracks

Davisville Station

PANDA

St. Clair transfer platform

PANDA

St. Clair vent shaft

CANADA PICTURES LIMITED

Eglinton lockers and telephone booths

1 Eglinton bus approaches

2 Eglinton loading platform

Eglinton bus platform

PANDA

1


2


JONES & MORRIS

College Street Station

Bloor transfer platform

PANDA

PANDA

Mezzanine at the Union Station

CANADA PICTURES LIMITED

Union Station Platform

Advertising

PANDA

Wellesley Station

Rosedale Station and bus platform

PANDA

Wellesley Station

Underpinning the Bank of Montreal

Underpinning most of the buildings along a mile of the main stem of Toronto was a phase of the Yonge Street subway construction which called for skill and experience as well as engineering planning. Underpinning is one of those jobs in construction that is not susceptible to exact analytical study that we usually associate with engineering because there are more than the usual number of indeterminate factors — work with existing materials of uncertain quality and the exercise of field judgement in unforeseeable conditions.

The basic problem of underpinning is to carry foundations of existing structures to such additional depth and adequate materials that they will not be disturbed or damaged by the contemplated new construction. This usually involves building additional foundations for each building affected and the additions often involve more actual work and materials than the original foundation, and, at times, have been known to exceed the value of the entire original building. Due to the normally radial growth of most cities, the principal business areas usually have many of the older buildings. Toronto is no exception to this and many buildings on lower Yonge Street are old and of different construction from those built in our times.

Foundation design depends greatly on determination of the bearing value of the soil on which the structure is to be set. Soils of high bearing value make simple foundation problems and soils of low bearing value give rise to problems of varying complexity. The low bearing soils, of which the Toronto clay is a good example, have a characteristic of changing their bearing value in relation to the extent to which they are confined, and, due to their somewhat colloidal nature, will not carry loads of practical magnitude until they have been somewhat compressed by the load. This is one of the usual problems of underpinning and is ordinarily solved by "borrowing" load, that is, individual parts of the new foundation are loaded beyond what they will finally carry by temporarily rearranging the loading so that during construction each part will in turn carry its permanent load and some adjacent part of the building. This prevents an initial settlement of the new foundation which would cause changes in the elevation of the superstructure. When this principle is understood, provision is made for it by the designing engineers and the application of pressure by the use of hydraulic jacks is made by the superintendents on the work.

When we say that underpinning is a problem of carrying foundations to a greater depth, we mean just that. When a structure is built at a depth below the foundations of any adjacent building the adjacent foundations have to be supported on ground at a depth that it will not be disturbed by the excavation for the new structure. The support must be to the bottom of the new excavation, to the line of influence of the excavation, or to sound rock. Because only part of the existing foundation can be temporarily supported at one time all the extra depth of foundations has to be excavated in small deep pits below the existing foundation and built up as a series of individual piers. On the Toronto work, the number of these piers varied between 3 to 28 to a building depending on size and design, and from 4 to 32 ft. in depth depending on the depth of original foundation and the subway structure. These underpinning pits were all excavated by hand. Due to the need for extreme care in making the pit sheeting very tight and the need to avoid excess excavation at the sides of the pits, no one has yet been able to devise a method for power excavation in this work. In most cities where a volume of underpinning is done there exists a group of supervisors and workmen experienced in this work. There has never been any great volume of this work in Toronto but there was an excellent supply of skilled men who needed little training for this specialty in the northern miners. After a few became acquainted with what was going on, their friends from the north came in and at times we had as many as one hundred and sixty underpinners working and most of them were miners.

In order to make a large radius curve between Yonge Street and Front Street alignment, it was decided to have the subway go under several buildings in the vicinity of the northwest corner. One of these is the old Bank of Montreal and its support was the most interesting item of underpinning on the entire job. The building is a heavy bearing-wall type, with very few interior walls and was founded on clay with inverted arch type footings. The position of the structure with regard to the building was that for a distance of 115 ft. the subway was under the building, of which 70 ft. was entirely within the limits of the building. The sub-grade of the subway is approximately 13 ft. below the surface of rock.

This somewhat striking combination of circumstances gave rise to four special problems which owners dislike, that were resolved by adopting two expedients which underpinners usually try to avoid, and involved a certain large item of expense which contractors would like to forget.

The problems: A building without much interior wall

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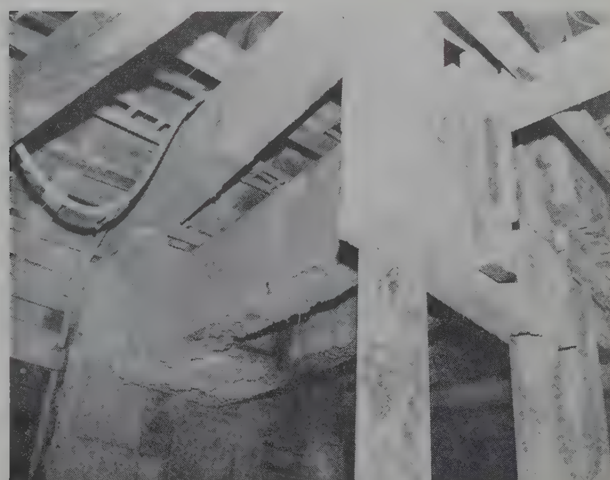
is just a shell to support. Inverted arch footings are very little value when their integrity is upset. A heavy walled building should be supported on a continuous wall to rock which cannot be done when the subway structure has to be built through the area that this wall would normally occupy. The rock is well above sub-grade but not of sufficient density to support heavy loads near the edge of a deep cut.

The expedients: Long beams which are usually avoided, were used in several places. Underpinning was carried to a considerable depth into the rock.

The expense of sinking underpinning pits into rock is a very significant item due to the size and location of the pits. Blasting was, of course, out of the question, and all rock in these four foot square and fifteen foot deep pits had to be removed by chipping and lifting out by hand.

At this point it should be mentioned that underpinning is usually designed by the contractor, subject to the approval of the Commissioner of Buildings. At the time the tender is being prepared the contractor's engineers make



These three illustrations show underpinning of the Bank of Montreal.

a preliminary design and if he is the successful tenderer, they make a complete design later. The final design could call for more or less work than was anticipated in preparation of the tender due to more thorough study by the contractor's engineers or different design premises on the part of the Commissioner of Buildings. In this instance, the first post-bidding study of the design indicated a quantity of additional expensive work to be done, and several designs were made in an effort to bring the probable cost into line with the anticipated cost used in the bid. Some excellent ideas and designing were developed to which compliments are due our project engineer, Mr Henry Schmeckpeper. Some fine economies were made but (now it can be told) the underpinning of this particular building cost the contractor much more than was anticipated in the bid, in which respect it was also a very unusual case.

The principal walls of the Bank of Montreal, under which the subway structure now passes, are diagonal to the structure and if supported on single spans would have

involved longer spans than are practical in this work. It was therefore decided to carry the walls on a two span arrangement with intermediate supports within the centre wall of the subway. Even with this expedient the spans were greater than we like to use, but they were within the limits of practical application. The use of beams on long spans is undesirable due to the basic need in underpinning for establishing a full load deflection in the new work without settlement of the existing structure. We can usually compute the amount of deflection necessary for the system of loading involved, but long sections of wall are statically indeterminate when they have been in place for a number of years. Although minor rearrangement of support is not serious, a major change in arrangement of loads can cause damage to a rigid masonry structure. The use of intermediate supports made it necessary to go to the elevation of the bottom of the subway in order to make adequate footings for the building without carrying load on the structure itself. This was done by excavating pits to an elevation below sub-grade, pouring concrete footings and placing steel columns within the limits of the centre wall of the subway. These columns in turn supported beams which were individually stressed, each to carry its proportionate part of the permanent load. The footings at the side of the structure were carried to same depth as the centre because the shale rock in this area was not considered to be sound enough to carry this loading at the edge of a cut. The general impression during construction was the Bank stood on a series of steel column stilts below ground.

This independent system of support is a legal necessity due to the building owner's right to support, even if the subway should be abandoned or demolished at a later date.

At the time of construction of the subway, all underpinning was found to be in proper position and the structure was completed without interference by the underpinning work. After the subway was finished and waterproofed, the cut was backfilled and the cellar of the Bank was restored with a cement floor and all openings in the foundation closed.

Our experience in underpinning work indicates that contractor and engineer have to be prepared at any time to adapt their plans to unforeseen conditions. To avoid danger due to delay, close co-operation between the contractor and the owner's engineers is essential. We are glad to say that the fine relations throughout the work with the T.T.C. engineers and their excellent cooperation were the greatest possible contribution to the success of the underpinning and all other parts of the operation.

Soils and Foundation Engineering

Design and construction of the Toronto Subway were materially assisted by foundation conditions of a generally satisfactory character. Even though this was expected at the outset of the project, on the basis of local geological information and from the records of previous building operations along the subway route, the Commission carried out most careful preliminary soil studies and maintained close inspection and supervision of all subsurface conditions until construction was complete.

In the downtown section, the subway structure rests on solid rock. The soil around the structure and upon which it is founded for the remainder of the section in tunnel consists of glacial till and heavy clay. Similar material is encountered in the open cut section but much of this part of the route has sand as the foundation material. Ground water is often close to the finished grade level but caused no serious or unexpected inconvenience during construction.

In 1944, at the outset of preliminary planning for the subway, a program of test boring and soil sampling along the proposed route was undertaken under the direction of R. F. Legget (then at the University of Toronto) as a consultant. Thirty-seven borings were put down with a total footage of 1,459 feet in soil and 68 feet in rock and 183 undisturbed soil samples were obtained. Special casings were placed in about thirty of the test holes and the level of ground water was observed in these for some months. Thereafter the number of observation wells was reduced but water level records were maintained in a small number of the holes until construction started.

Information so obtained and that derived from a careful study of local geological records were used in preparing the contract documents. The information with regard to soil properties in particular enabled structural designs to be prepared with certainty. All the subsurface information obtained for the Commission was made available to those interested in tendering for the work, but contractors were naturally required to satisfy themselves as to subsurface and ground water conditions before submitting bids.

The soils of the Toronto area have long been internationally famous because of the inter-glacial beds which they contain. The excavation for the subway had therefore unusual scientific interest. Fortunately, it proved possible to obtain the desirable geological information as excavation proceeded in association with the essential recording of subsurface conditions for engineering purposes.

This was done through the co-operation of the Division of Building Research of the National Research Council. Started in 1947 as a service to the construction industry, the Division sought and readily obtained the permission of the Commission to utilize the subway construction as a large scale building research "laboratory". R. F. Legget

had moved to Ottawa in 1947 to organize this new N.R.C. Division and he was therefore able to keep in touch with the subway subsurface studies in his new capacity as Director of the Division, although not as a consultant. As a result of this co-operative effort, W. R. Schriever of the Division of Building Research spent two years in Toronto as Research Engineer on the subway, working as if a member of the staff of the Commission. He was directly responsible for obtaining complete details of all the soils encountered during the excavation.

Soil samples were taken at fifty feet intervals and a detailed soil profile of all soil and rock encountered by the excavation was maintained. Standard soil tests were performed whenever necessary. It was found that the soils encountered agreed remarkably well with the profile suggested by the test boring program. Properties of the soils encountered in excavation were similarly very close to what had been anticipated from preliminary studies.

Because of the special geological interest of the soils encountered, the Commission arranged to pass over to the Royal Ontario Museum of Geology for safe keeping all the soil samples obtained. These samples are now being carefully arranged by the Museum authorities and so will be permanently available for future study by those interested. The geological conditions revealed by the excavation have been correlated with the local geology of the Toronto district. A symposium on this unusual aspect of the subway work was presented at the meeting of the Geological Society of America, which was held in Toronto in November, 1953.

Some attempt was made to measure the earth pressure exerted upon the bracing used in the cut and cover construction of the subway, but the methods used and the speed at which construction was carried out did not permit any extensive program in this direction. Two permanent installations for the measurement of soil temperatures beneath the subway were made. These will enable a study to be made of the heat loss from the subway structure in the next few years. Studies of vibrations due to pile driving were also carried out on the mutual basis already described, but the principal research project carried out on the subway construction was a detailed study of the actual strains and stresses set up in the temporary steel deck used to cover Yonge Street, under maximum traffic conditions. Although this work is not directly related to foundation conditions it may be usefully recorded here that a technical paper describing the results of these studies will shortly be published, it is hoped, by the Institution of Civil Engineers of Great Britain.

In conclusion it may be said that the construction of the Toronto Subway clearly demonstrates the advisability of thorough preliminary subsurface investigation, and has demonstrated the value of continuous attention to ground water and soil conditions as they are revealed by excavation. The co-operative research program carried out by the Commission and the Division of Building Research of the National Research Council is believed to be a pioneer venture of its kind. It shows clearly the value of such practical research not only to construction operations such as the building of the subway but also as resulting in scientific information of general service.


Temporary support of utilities

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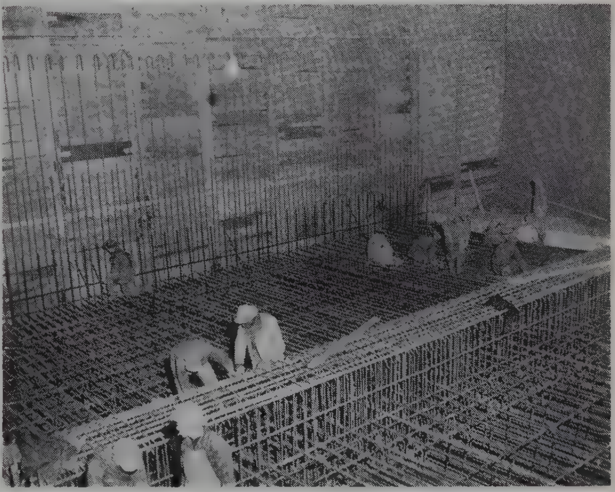
Pile driver in action


Placing reinforcing steel

Subway Drainage and Station Plumbing

Subway drainage was designed to convey a discharge from the following sources:

a) rain water from open stairs, vent shafts, and occasionally roofs
b) seepage water through structure
c) cleaning water from stations
d) emergency, such as: flooded streets, broken water mains or fire.

Sewage from station washrooms is being discharged separately into city sewers.

Stair drains, floor drains, drain pit and catch basins are strategically located along the subway to intercept water and discharge it through 3″ to 6″ extra heavy cast iron pipe (sometimes 6″ close joint vitrified-clay pipe in concrete fill) to a main underneath the subway.

All cast iron pipes, if not encased in the structure concrete, or fully exposed to permit inspection and maintenance, were enclosed in fill concrete.

The main, except on curves, runs under the track centre line from 3′-11″ to 5′-11″ below the top of rail and usually follows the subway profile. Generally constructed of 8″ vitrified-clay pipe, it is an open joint tile pipe covered with crushed stone in rock subgrade, and a close joint tile pipe in concrete fill for earth subgrade.

Manholes, located every 160 to 360 feet, provide for connection of branches and for cleaning. One manhole at each station has been deepened to provide for collection of silt.

For about 11,000 feet of subway run in the downtown area the main drain is located below city sewers. Therefore, three underground pump rooms are provided for the Yonge Street subway and one pump room for future Queen Street subway.

Pump rooms are located about 3,000 feet apart. Pumps are vertical, heavy duty, submerged sewage pumps, installed in pairs with specified capacity of 500 U.S.G.P.M. for each 4″ pump and 750 U.S.G.P.M. for each 6″ pump. Electric motors range from 10 HP to 25 HP each, 1750 RPM, 208 volt, 3 phase, 60 cycle. Maximum head in case of flooded street goes up to 72 feet. Impellers are specified to pass 2½″ solids. The size and capacity of the pumps selected were for an estimated emergency condition and considering existing installations. Actual seepage was found to be less than about 0.1 gallons per hour per foot of subway in average.

Mechanical alternators, solenoid lubrication and high water alarms are installed to assure a satisfactory automatic operation. A high water alarm bell is installed in supervisory control room and provision is made in pump room piping for portable pump connection in case of emergency. In view of heavy condensation all controls are in boiler plate or cast iron enclosures.

A small single drainage pump is installed in a sump at the entrance to the Toronto Terminals Railway Station for entrance drainage. An air ejector, manually operated, is a stand-by for emergency.

All washrooms in stations are staff washrooms with exception of Eglinton Station where, as a terminal, public washrooms are installed.

Five of these washrooms are located below city sewers and are equipped with mechanical sewage ejectors composed of duplex vertical 2″ sewage pumps. The specified capacity of each pump is 25 U.S.G.P.M. Electric motors are ¾ HP to 1½ HP, 1750 RPM, 208 volt, 3 phase, 60 cycle. Each unit is installed in a 2′-6″ x 3′ x 4′ x ¼″ welded steel tank. High water alarm bells are installed in respective ticket booths.

Hot water is provided at each station by hot water tanks of an average capacity of 100 gallons with 3 KW heaters for each platform or public area.

The subway structure, including finish, is of non-combustible material, nevertheless a fire protection system has been provided with fire hose cabinets installed at each platform of all underground sections with 250 feet of 2½″ hose at each cabinet with necessary nozzles and tools. Nineteen fire hose cabinets are installed throughout the subway.

Pipes used for plumbing are, as required by the city of Toronto by-laws, cast iron soil pipe, copper tube, brass and wrought-iron pipe galvanized, centrifugally cast iron pipe as well as some amount of lead pipe for connections.

Certain difficulty was encountered in the location of vent and fresh air intake pipes at street level. In several locations some unusual solutions were required.

All plumbing fixtures are of a standard type, vitreous china with flush valves and self closing faucets.

All pipes conveying water are insulated to prevent heat loss or condensation. In spite of this, considerable condensation was noticeable prior to subway operation, thus to prevent soaking into the insulation a protective coat of paint has been given all exposed pipes.

Subway Ventilations

Subway ventilation has been designed to meet the

following requirements:

a) dissipation of heat produced by moving trains, lights and people during summer months.
b) relief of blasts produced by trains approaching and leaving stations.
c) air circulation with moisture relief in winter or in a comparatively dry outside weather condition.
d) emergency: to exhaust objectionable fumes in case of fire or smoke.
e) auxilliary ventilation when required.

Considerable research was done to evaluate the expected amount of heat produced in subway. It was estimated that the heat range may be, at peak time, up to 1400 BTU p.hr.p. foot of track of the subway, when operating at full capacity.

Fortunately, moving trains produce considerable air motion which, if sufficient outlets are provided, will induce a satisfactory ventilating effect.

It has been estimated that the provision of vent shafts and fan shafts on both sides of the subway at about 450 to 600 feet distance in downtown tunnel section will take care of adequate heat dissipation.

The uptown section does not present such a severe ventilating problem due to shorter portions of tunnel sections.

As some air motion induced by trains would produce objectionable blasts along the platforms, vent shafts are located at each end of each platform to relieve these blasts. Fan shafts are generally located one in each wall midway between stations.

When trains are not in operation, there still exists at the present time a distinctly noticeable natural ventilation due to about 100 feet difference between the lowest sidewalk elevation and the top of rail elevation of the portal to the open-cut section.

To supplement or substitute the ventilation effects already described a possibility of forced ventilation has been provided. Fifteen fans 72″ in diameter are installed in fan shafts along the subway. These fans are V-belt driven, axial flow type with rated capacity 50,000 CPN, at ½″ SP. Motors are splash proof 10 HP 208 V. 3 phase, 60 cycle. In two cases where excessive fan rotation due to blast from trains was expected, spring loaded electrically released brakes are installed on driven shafts. All subway fans are primarily intended for emergency operation.

Location of fan and vent shafts is such, that it is always possible to block off with air any 450 to 650 feet stretch of the subway by simply opening or closing louvres in vent shafts and operating fans for exhaust or intake.

Fan and vent shafts are reinforced concrete structures, rectangular in cross section and extended from almost top of rail elevation to sidewalk or above ground elevation. Heavy grating to withstand a 10 ton truck load covers outlets on sidewalk half of its width. Free grating area is 106 sq. ft., for most of the vent shafts and 70 sq. ft., for most of the fan shafts. One removable section of grating, a ladder and door, provide emergency access to subway through each shaft.

All shafts are equipped with horizontal louvres in subway walls. Vent shaft louvres are operated from platforms, and fan shaft louvres close automatically when fans are operated from supervisory control. All louvres are operated by a separate controller for each 8′ x 8′ – 6″ unit and can be adjusted manually for required amount of free air.

The system assures considerable flexibility to meet unexpected requirements including possible complaints about air velocity through gratings.

Station Heating and Ventilating

Forced ventilation is provided for all washrooms, ticket booths and battery rooms as separate systems.

Heating schemes differ depending on the size and location of stations, but forced air heating has been adopted as a general scheme for all washrooms, and public areas.

All washrooms of the stations located underground are provided with thermostatically controlled forced air heating from electric heaters of a capacity from 2.5 KW to 7.5 KW, with blowers and filters. Ticket booths are heated by resistance type electric heaters. Public areas are unheated.

All above ground stations are provided with heating of public areas, washrooms and ticket booths. Forced air heating is of a continuous supply type with air temperature thermostatically controlled. Heating medium depends on the size of a station. Those with a heat loss from 75,000 BTU/MR to 550,000 BTU/MR are heated by hot water from electric off-peak load boilers of 50 cu. ft., to 150 cu. ft., capacity. Boilers work on fully automatic control and 600 DC power. A supervisory control switches boiler heaters off whenever power demand for traffic rises over a preset value. Stations with larger heat loss or where steam is available in direct vicinity are heated from steam boilers. Open ticket booths are heated with blower type electric heater. It was necessary to install electric strip heaters in several locations to lessen the condensation or freezing hazard.

A bus transfer tunnel at Eglinton Station is ventilated by a supply of 20,000 CFM of warm subway air to prevent possible accumulation of gases from bus area.

The heating and ventilating system as described above offers reasonable comfort in waiting areas and protection for plumbing system against freezing.

Escalators

There are thirteen escalators installed throughout the subway.

Width of escalators is 32″ or 48″ with a rise from approximately 9 ft. to 17 ft. Their capacity is from 4,000 to 8,000 persons per hour. A provision has been made for installation of 8 additional escalators. All escalators are "motorstair" type of the Peelle Company and are reversible to provide for changed traffic direction during the day.

All modern features are incorporated into design including safety devices to provide proper operation.

There are emergency stop buttons at the upper and lower landings and at the ticket booth. Handrail and chain safety devices cut the current off and bring the escalator to rest whenever brake or tension devices operate in case of breakage or slackening. Mechanically applied and electrically released brakes on motor shaft and main drive shaft can make an almost instantaneous emergency stop.

Escalators are mounted on heavy steel trusses with drip pans underneath.

Stainless steel covered ballustrades and stainless steel trim provide for attractive appearance and cut maintenance costs.

All steel is grounded to prevent an accumulation of static electricity and possibly attraction of passengers clothing.

Shop Equipment

To accommodate all subway cars and to provide for car and track maintenance some 15 acres of land are taken over for yards and shops.

The shop area is heated by a central boiler room with stoker fired steam boilers of over 12,000,000 BTU/MR total capacity, 15 p.s.i. pressure with forced condensate return from condensation pumps.

Car shop is heated by thirty thermostatically controlled, individual blast type steam unit heaters hung from the roof. All pits, offices and washrooms are heated by hot water panels in floors from a converter controlled by outside weather controller. An adequate ventilation of tempered air is provided for windowless areas of over 9,000 CFM capacity. Two roof ventilators of 9,200 CFM capacity each are installed for paint booth ventilation.

Of other equipment in the shop the following might be worth mentioning:

- Dust removal system with air washer for car track cleaning. Capacity 12,500 CFM.
- Four wheel grinders with exhaust system through centrifugal type grinding dust collector. Capacity 1,560 CFM.
- Three drop tables with a 20 ton hoist for car truck installation.
- Automatic car washer with detergent spray.
- Material handling equipment such as 9-ton hydraulic hoist and 2-ton crane.

Fire protection of yard area consists of 10 monitor towers, 9 hose houses, numerous post indicating valves, fire alarms and watchman stations. Inside the car shop a dry-pipe sprinkler system of about 1,150 sprinklers is available with fire extinguishers in strategic points.

The owners

CANADA PICTURES LIM

Architecture and the State

A paper read before the Vitruvian Society, Toronto
by Anthony Adamson

In these days, when the power of the state is increasing its control over most social activities, I believe it is not inopportune to take a look at the influence which the state is having upon architecture.

I had, myself, to exercise the power of the state this month, and brought to bear the legal requirements of society by supporting our building inspector in his condemnation of the foundations for a house designed by an architect for his own personal habitation, and also of the footings of a building designed by a professor of soil mechanics. It gave me pause.

In every civilization which has built cities there have always been building inspectors – those evil, ignorant, warped jacks-in-office who have attempted to frustrate what they have called hare-brained designers who, just because they had a college education, think they should be allowed to do what they like. And, in every civilization, also, there have been those unenlightened politicians who have incorporated the mediocre norms of the masses into laws – and thus frustrated the ideals of leaders and thinkers.

I suppose I now stand among the latter class – of unenlightened politician. Certainly had I been Reeve of Athens back in the old days and got caught between the ratepayers and that man Phidias with his expensive architectural notions, I know whose side I would have been on. Pericles was bright enough, I suppose, but he ought to have seen that a man who would put six hundred and twenty-five pounds of gold plate on a statue would lose him votes.

I do not want to give my talk too erudite and classical a flavour, and though I should very much like to go back into the history of classical architecture and the influence of the state on it, I must content myself with the classic quotation from Vitruvius on building by-laws: "Jura quoque nota habeat oportet ea quae necessaria sunt aedificiis communibus parietum ad ambitum stillicidiorum et cloacarum, luminum."

In spite of the intelligent look on some of your faces I know that you do not understand a word of it. It is, I suppose, a "ploy" by an unenlightened politician to get "one-upish" – yet, Mr Chairman, you could scarcely expect me tonight not to quote Vitruvius whose name we have honoured in this society, even to an uncultured audience.

My intention is, however, to be entirely contemporary and to examine one, possibly two, systems of state regulation to see if we can find suggestions for improvement in our architecture and in the look of our streets. I am not so unenlightened as to think that state regulation "per se", as Vitruvius would have said, can produce good architecture – ad hoc – but can it help? If it can, how much of it do we in Canada want?

First let me ask: Where is the world's best architecture and what role does the state play in its creation?

As we all know, whenever we want the truth, whenever we want to establish without peradventure a criterion in architectural design, we must go to a fourth year student in the School of Architecture at the University of Toronto.

From this unimpeachable source I have it that the best architecture in the world, and the best contemporary architects, are in Switzerland. And that of all the towns of Switzerland, Zurich offers as good a criterion of contemporary civic design as we may find. I intend, therefore, to examine at some length the Zurich civic authority and then the Swiss profession of architecture.

The Cantons of Zurich and Bern both passed, in 1894, two of the earliest pieces of legislation which compelled towns to plan their physical growth. Other countries had previously passed laws to regulate the safety of buildings and to safeguard the health of their inhabitants, and so I imagine had the Swiss, but I know of no earlier legislation in Europe in which the state compelled cities to plan. We do not yet have such a law in the whole of Canada.

The Zurich Cantonal Building Act (Baugesetz) compelled the two city communes of Zurich city and Winterthur to enforce certain minimum building restrictions, to prepare plans of areas about to be developed – and permitted them to make detailed regulations of many kinds concerning building and buildings.

As a result of this legislation, this Building Act, the approach to town planning in Switzerland has been through the control of buildings, and hence has developed a more architectural approach than in Canada where we have legislated to control the use of land and so prevent the abuse of it by land speculators. I believe that the spur to the enactment of building controls in Switzerland was originally a desire for safety in construction and for construction workers. In England, the Netherlands and Germany, town planning came into gradual being as a corollary to improved housing conditions for the "working classes", and has developed, therefore, in these countries

with a more social intent.

Since 1894, one-third of the area of the Canton of Zurich and five-sixths of the population have voluntarily adopted provisions of the 1894 Act. The three main legal instruments of building control under this legislation are the Building By-law (Bauordnung), the Alignment and Street Grade Plan and the Neighbourhood Plan (Quartierplan).

The Bauordnung is a curious document to a Canadian as it combines what we would call a Building By-law with a Zoning By-law. All those I saw were very short and gave immense powers of discretion into the hands of a city architect. In Canada we combine the law-loving qualities of the British with, shall we say, the more vigorous independence of the Americans. As a result, we wish to write laws of the greatest complexity and detail and yet directly they are written we are all prepared vigorously to support contraventions of their intent, if we can find some legal technicality on which to do so.

The booklet in my hand is the combined zoning and building by-law of the capital of Switzerland. It is thirty pages in length. This is all it says about the, to me, controversial item of foundations: "Die Fundamente sind in einer Stärke auzulegen, die/der Belastung und Tragfahigkeit des Baugrundes entspricht".

The Swiss equivalent of zoning is done by the prescribing two, three, four or five classes of buildings ("Bauklasse") and setting these out in zones on a map. While we, in Canada, are evolving a system of classifying land uses and leaving nothing to discretion, the Swiss have evolved a broad system of classifying buildings and leaving an immense area of control to the unspecified discretion of officials, including the use of land for commercial purposes.

The chief instrument in force to control the use of Swiss urban land is the building line. Originally, this was intended only to set the alignment of façades, but has come to be used to set the more or less exact location and size of buildings on land.

In order to try and explain how this system of state control is used to influence the architecture of Zurich, I must first describe the civic organization through which the control is exercised.

The excellent municipal administration of Zurich is divided into six main departments: Finance, Police, Health and Welfare, Building Department 1, Building Department 2, and Public Utilities Department.

At the head of each is an elected "stadtrat", a full time controller whose position is similar to cabinet minister.

Building Department 1 has seven divisions. The first is the Tiefbau office, or literally the "deep-building" office. This division exercises the power of the state on the design of streets and of all construction below grade, and at grade level. The second division is the General and Neighbourhood Planning Office (Bebauungs und Quartierplanungamt) which prepares physical plans of the city. The remaining divisions deal with street maintenance, handling of road material, surveying, parks, and forestry. Building Department 1 is under the city engineer.

Building Department 2 has five divisions. The first is the Hochbau office, or literally "high-building" office. This division exerts the power of the state on the design, colour and location of buildings, signs, street furniture, etc., and, where thought advisable, does the designing itself. The next division inspects buildings to see that they conform to the building class, their design and location prescribed by the Bauordnung. The next two inspect construction from the point of view of structural soundness, and fire resistance. The last regulates new buildings in new neighbourhoods which have been laid out in a quartierplan by Building Department 1. Building Department 2 is under the direction of the city architect.

With the use of the sixty year old Zurich legislation and the organization which I have briefly described, these two Building Departments of Zurich design the city. There is a great deal of building going on in Zurich, both in the redevelopment of its commercial core and in new development on its fringes, and their designing is most effective. It is true that the genius of individual architects contrives to give the city much of its flavour, but its beauty as a contemporary city, in my opinion, is due more to the architectural arm of the state than to the individual design ability of the local architects. The rationality of the controls seem to me to encourage the design of individual buildings. If this is true it is an important conclusion.

The plan for new streets is not made by a land speculator handing in a plan for his ownership and getting it approved, as in Canada. The whole plan of a neighbourhood or "quarter between two main highroads" is made by Building Department 1. After it is made, it is studied for "hochbau" which means that the street and utilities plan is put in the hands of the city architect in Building Department 2 to make sure that the design and location of all new buildings will conform to the design of the city. The city architect studies the area and prescribes the block plan and massing of buildings by laying out building lines and setting up building classes. These additional restrictions are sent to the executive council for approval. In some Cantons they may be referred to popular referendum.

When the plan and regulations are prepared, the developer and his architect design the buildings in conformity. The city architect expressed to me the obvious that "good architecture cannot be obtained by regulation", and he said he was careful not to let his regulations become rigid. Hochbau, like architecture, is an art requiring flexibility and taste. However, there are under the city architect five artist-painters whose job it is to mix and choose the colour of paint to be used on the exterior of all Zurich buildings. The colour of Zurich varies from dark ivory to pale beige in consequence of the city architect's taste. In Murton, on the contrary, the main street looks like a stage set from a technicolor musical. The most brilliant colours are used and a canary yellow building with violet trim will stand next to a lime green building with white trim, but the ensemble will be obviously dictated by hochbau.

A typical by-law clause taken from a Bauordnung of an urban/rural suburb of Bern (Koniz) in somewhat the same position to Bern that Toronto Township is to Toronto, reads as follows: "All buildings or parts of buildings or appurtenances thereon shall be architecturally satisfactory, and so built that the look of the street, village or countryside is not disturbed thereby. Specifically, the Executive Council (Stadtrats) shall have the right to rule on the

colours of paint used on the outside of buildings."

Hochbau also sees to it that signs conform to the city design. There are city artists or architects whose job it is to make freehand perspective sketches of private and public signs, and to see that no sign impairs the design of a street or abuses the general appearance of neighbouring buildings.

Hochbau also sees to it that buildings of historic interest or great architectural merit are preserved. To regulate this, the city architect is assisted by the normal European type of "Commission for the Control of Aesthetic Questions", the majority of whom must be architects.

The city architect of Zurich, besides exercising the controls just mentioned, and besides laying out in block model form the more important architectural massing in the city, specifically designs from time to time a few public buildings, and all churches of the established Protestant religion. He makes sketch and site plans of all new public buildings, hospitals and schools which are then either given out to architectural competition or to individual firms, but he provides the architectural supervision. If a cooperative, a private company, or the state (Canton or commune) wish to ask the city architect to design a housing project, he may design it.

In Building Department 2 under the city architect in the single hochbau division is a staff of about forty-two. In Building Department 1 under the city engineer the Tiefbau division has about forty-five, the neighbourhood and general planning division has thirty. This does not include surveyors for whom there is a division with a staff of twenty-two.

Zurich has a population of about 400,000. Toronto has a population of about 650,000. The Staff for Planning in Toronto, including surveying, totals twenty. The total staff in Toronto's Department of Buildings is sixty-two inside men of whom approximately ten are draftsmen, sixteen deal with building permits and two with sign permits.

Swiss democracy, as you may know, stems from a tribal origin, and is both elementary and comprehensive. Laws are not passed; they are "accepted by the people". Citizens have to go to the polls almost weekly on all kinds of matters, including certain neighbourhood plans and the design of housing projects. As an example of the effect of Swiss democracy on civic design, the story of the Globus Department Store in Zurich is illuminating, and has perhaps some relation to the title of my remarks.

An important bridge across the river in Zurich had for many years had shops attached to it. It was narrow, and the location of the shops caused a traffic bottleneck. The Tiefbau division recommended enlargement of the bridge, and the removal of the shops, including a department store. It also recommended the relocation of the store at the end of the bridge after the latter was rebuilt to a greater width. The Hochbau division had its say on the look of the new store building, and the City Council approved. The proposal was then referred to the people who voted acceptance. The Globus Co. was then given an abandoned school as temporary quarters and the old bridge and store were demolished.

When the store came down and opened up a new view, many people of Zurich did not want it replaced. By Cantonal law, a certain number of citizens may demand a recall vote on any matter. The requisite number petitioned, the recall vote was held, and the plan as it affected the Globus Co. was turned down. The company was quite happy at this turn of events as they were making good money in their new location. The Tiefbau division recommended that they stay in the school, but the Council wanted to turn the school grounds into a park, so they told the Tiefbau to look for another site. This they could not find, and recommended that the Council hold a third vote to ask the people whether they really wanted to pay seven or eight million francs for a new site. Meanwhile, local merchants by the bridge found their customers reduced owing to the relocation of the Globus Co. and started collecting signatures for a third, or would it be a fourth, vote. What happened after that I do not know.

Were the Regent Park project to have been in Switzerland, their City Council would not only have had to refer a money by-law to the people, but the plan to a public hearing. The objections of those whom they could not satisfy at a public hearing would have had to have been printed in a booklet with the reasons why the city wished to ignore them. This booklet would then have had to be circulated to ratepayers, complete with plans and description of the project, and on the next Sunday all males could, and should, have gone to the polls. In Ontario, it is not allowed in the Municipal Act for municipalities to spend money on influencing the vote for or against any matter referred to the people – in Switzerland, it is compulsory.

In the support of the arts, the Commune of Zurich, as do many others in Switzerland and Scandinavia, requires 1% of the cost of every public building to go into the purchase of painting or sculpture. You have no doubt seen some of the results. Swiss taste in sculpture does not appear, to me, very high. It may be my Toronto background, but the plump little bronze nudes of Zurich look too like naked women to me – or what I am informed women, when naked, look like. I remember one stone giraffe, however, in a school ground which was the focus of affectionate attention by every child. On their release at the end of the day, scarcely a child did not slap it or pat it or crawl through it or over it or under it on his or her way. Our Toronto children, of course, would have hacked pieces off it and written four letter words all over it – or would they?

Last week I had occasion to engage in a slight argument with a VIP as to whether or not the Township of Toronto should make definite plans for the staggering of high school classes in 1955 because there was a shortage of municipal credit. In Toronto Township, our carpenters, school teachers, insurance salesmen, VIP's and everybody else make about 75% more than they do in Zurich, yet in Zurich they can afford naked women in parks and giraffes in school yards – as well as new high schools.

The profession of architecture in Switzerland is not, as in Canada, a closed profession except in one French speaking Canton. In the rest of Switzerland, anyone may call himself an architect. That exasperating builder person who avoids having 6% drained off into a Vitruvian pocket exists, but in Switzerland calls himself a "spec architect."

There are two professional associations known as SIA and FAS. SIA admits the engineer, and entrance to it requires a diploma or degree. FAS is more elite and Vitruvian. It publishes the magazine *Werk* and admits designers of furniture, and other riff raff.

All big public jobs are obtained by open competition, lesser public jobs by competition among selected architects. Many private jobs are also awarded in these ways.

Another difference between Switzerland and Canada is that the general contractor and architect are the same person, and there are no overall tenders. The architect's "estimate" of total cost is what the client works to. In many Cantons, the state requires that, if the "estimate" is more than 10% high, then the architect must pay the difference up to the limit of his fee. The Swiss architect, also, has to be more on his toes than the Canadian as he does not have that happy clause in a contractor's agreement which indicates that, if there is any doubt, it shall be the fault of the general contractor.

I have no Gallup poll of Zurich architects on their reaction to hochbau restrictions, but those I talked to behaved like architects the world over. The main job of a city architect, they thought, was to control "spec architects", and get them to associate with a decent SIA or FAS member. A city architect should not take jobs from private architects. The imaginative architects descried the "ein-topf" – one pot – style which hochbau encouraged. Once it encouraged a look, they said, all spec architects adopted this look. It then became normal, and capital would flow only into the normal look. Some said Swiss architecture was in decline. One pointed to the sad end of Swedish architecture through lack of freedom, and said, "In Sweden a child has to be nine before he sees out of a window" because window factories have established a norm in window sizes.

The more successful architects seemed not to be checked as much by the city architect as he lead me to believe, due, perhaps, to their influence within the architectural associations. I asked one of these VIA's whether a butterfly roof would be allowed in Zurich, or a wall made of hard coal and fused bottle glass, and, though the conversation became somewhat confused as even VIA's in Switzerland are not as advanced as the fourth year at the Toronto School of Architecture, the impression I gained was that he would see the hochbau in hell before it vetoed one of his designs.

The training of architects in Switzerland at the universities or technical schools did not impress me very much. The VIA's said that graduates were taught only to win competitions, and when they had to do the job God intended them to do, which was to make money in offices for the VIA's, they were unfitted for it.

The fees set by the associations for architectural services for a building over 3 million francs ($740,000) were: preliminary sketch 0.3%, sketch plans 1.0%, working drawings 2.0%, control (estimation and general contracting) 1.7%, supervision 2.0% – total 7%. But as I have said, the state takes no part in professional organization or fee standards.

I have, perhaps at too great length, talked of the relationship of architecture and the state in one single country. I have done so because I believe that in that country the state restrictions are largely responsible for the high standard of architecture and civic design.

Behind the Swiss State restrictions lies a simple aim, the old aim "firmnesse, commoditie and delight". This is not the motivating influence behind state restrictions in all countries nor in all periods of history. The ancient Egyptian State was not interested in these qualities – nor in beauty. The quality they sought and enforced they called "nefer". It meant "worthiness", and was based on an ideology. We have our ideologies today, most notably in countries with communist governments, and that means in over half the world. In half the world, the state, in a large degree, sets the official way in which architecture may express the quality "nefer" – the true way, the Marxist way, the only way in which architecture may give "delight".

We are all conscious that in "bourgeois plutocracies" or, as we would call them, the "free world", the style or character of a building is sometimes set by the client. And "delight" to many a client arises from profit. Both Swiss and Canadian state organs, such as CMHC, may cause the design of a house to be a little more delightful by requiring it to conform to a norm which will permit its ready resale, and, hence, not endanger 5¼% mortgage money. The Russian communist's criticism of our freedom in architectural design is that it is not freedom, but subservience to the profit motive, or subservience to the glorification of some anti-social operation such as banking or life insurance. How much better, Russians say, to establish a true socialist character in architecture by intellectual discussion, one that expresses socialist society, and then have the state organs to see to it that buildings conform to it. We scorn Russian architecture as formal and pretentious – two nasty words to us – but to a national, whose state has more form and more pretentions than ours, these qualities seem quite appropriate.

It would be of interest if I could comment on the practice and profession of architecture and civic design in a communist country. Possibly Poland would offer the best criterion, but I have no first hand knowledge of that country. The only communist country I have recent knowledge of is Yugoslavia.

In North America, we think of communism primarily as a dangerous political force, which under Russian direction it may be, and not as the difficult, fussy and still experimental economic way of life under which ordinary people try to carry out their daily tasks. A communist country is one that has nationalized its means of production. All but a handful of privately operating craftsmen work for a communist state: architects work for the state, all of them. The state finances its operation on the "accumulation" – Marxist word for profit – of state enterprises. Levels of government have their own set of state enterprises. For instance, in a large Yugoslav city there will be two restaurant chains, one chain will send most of its accumulation to the government of the local People's Republic or Province while the other, or cheaper class, will send it to the government of the municipality. The accumulation of certain manufacturing enterprises are split four ways, bonus to worker, and funds to the three levels of government. Funds for the support of a municipality appear to come

70% from such "accumulations" and the remainder from local excise taxes and taxes on private craftsmen and farmers. Not only was Yugoslavia overrun and its plants and cities considerably destroyed by two invading armies during the war, but it suffered years of the most agonizing civil war. At its pre-war best, it was an underdeveloped, poor country and technologically backward. It is still poor, underdeveloped and technologically backward, and thus the exact opposite of Switzerland. The economic system under which they are attempting to go forward seemed to me to be still in its theoretical infancy. The break with the Cominform broke all their original economic plans upon which all their physical plans for municipal improvement were based. Municipalities seemed to me to be more at the mercy of uncontrollable economic forces in Yugoslavia than in non-communist countries. The intergovernmental relationship in financial matters seemed to me to be wide open to friction, and not possible to function without the guiding hand of a party organization. I can think of only one worse political job than the one I have, and that would be to be chairman of a Yugoslav party organization at the municipal level.*

I found the attitudes of architects in Yugoslavia to be the same as those of other countries. In their schools of architecture, they were not, so far as I could see, taught any party line in architectural style as appears to be the case in Russian dominated countries. They were taught to consider to a greater extent than our students the social impact on a town of any large building. That, I think, is good. We work for private clients who do not have to consider the social impact of their buildings on street or town, except for limited by-law restrictions. They work for the state. Their clients are state "investitors".

A state investitor is a corporate body having control of certain public funds to invest in a certain enterprise. The belief is that a state enterprise will have a more comprehensive understanding of the social and physical needs of a community than a private enterprise. In my limited experience as a politician, I have found that state enterprises in Capitalist countries such as the Ontario Department of Highways, the H.E.P.C. and, what was until recently a state enterprise, the A.V.Roe Co., have less intelligent interests in civic design and the social impact of their works on a community than do private companies.

Architectural offices are themselves state enterprises. When a young man graduates from a Yugoslav school of architecture, he is not guaranteed a job. As with us, people try to point to the need for architects to serve in country towns, and, as with us, the young men want to stay in the big cities. The large state enterprises, as with us, have large architectural offices. The state enterprises and investitors who do not have their own offices go for architectural service either to the nearest or to the chosen architectural state enterprise which designs and supervises construction for them. In Yugoslavia, these now have to operate at a profit. Cities are required by law to prepare plans, and these plans have, in effect, to be begun at the Republican or Provincial level. In two of the republics, the planning offices are state enterprises now, and have to operate at a profit. At one time, the federal and, some Republican governments, each had their own architectural enterprises in their capital cities. This is no longer so, and independent architectural enterprises now serve all levels of government. The city architects of Belgrade and Zagreb did no building, or so little that it amounted to nothing. The army seems to be the only government agency which still supports a large architectural office.

In Belgrade there are six main municipal departments: Department of Economics and Economic Planning, Department for Education and Culture, Department for Communal State Enterprises, Department for Public Works and Physical Planning, Department for Housing, Department for Public Health. The detail plans for the development of Belgrade prepared in the civic department do not appear to be what we would call legal documents. There is one master plan of land use designations which indicates the uses legally permissible, or rather the uses to which one branch of the state wishes to indicate to other branches of the state that it would like. I noted that in Yugoslavia the state frequently disregarded what it told itself to do without apparently going through the motions of amending the plan or regulation which it was disregarding. The detail planning tended to cover the whole of an urban area with an ideal building block layout which had no legal force, but I imagine acted as a guide to development. Planning, like so much in Yugoslavia, had a dreamlike quality and a faith in the future which I could not fully share with a country so poor, and so, as yet, unorganized. Even items in it which have been carried out show more faith than fact. Fine great blocks of apartments up to eight storeys high have been built with elevator shafts but no elevators, to house families who cannot afford curtains, and now cover their windows with pasted newspapers. Nearly all stand forlornly in a sea of clay and brick-bats as the municipalities of Yugoslavia are almost as poor as Toronto Township and cannot afford sod. It seemed to me to be an attempt in Yugoslavia to boost the standard of living by constructing public housing of a standard beyond the present means of the economy. Of course, in Toronto Township the poor, that is the families who can only afford a 17″ TV screen, have to live in private shacks and we do not build them anything.

The problems which face state governments in Europe are incomparably greater than those that face us in Ontario. We are in a period of prosperity and expansion never before experienced in Canada. The Dominion Bureau of Statistics tells us that the average annual income of an architect in 1951 was over $10,000, and he was effectively the highest paid professional. Certain towns are expanding at an unbelievable rate. The per capita construction of dwellings can compare with any country in the world. In the number of new towns constructed from scratch, we probably lead the world except perhaps for two much larger countries. The Canadian throughout the world is regarded as the epitome of practicality, a humourless, uncultured, flagless machine. Can we as architects, point with pride to the "firmnesse, commoditie and delight" of the physical developments that have taken place in our cities since the end of the war? Even if they have no great "delight", have they "commoditie" for traffic and open

*Mr Adamson is Reeve of Toronto Township.

space, or "firmnesse" in a physical or economic sense?

In answering that question to myself I can only point to failure, personal failure perhaps, in my own municipality. It is not delight that brings five hundred families to Malton to live directly under a jet plane flightway in a largely rural and empty municipality; it is not delight that causes a beautiful stand of white pines that I knew as a boy to be lying bulldozed in an open pit fifteen foot deep in a new subdivision in Lakeview; it is not delight that causes people to buy into our endless little rows of boxes with startling roofs and aluminum screen doors. Nor is it commoditie that provides only 200′ of municipally owned lake frontage for 39,000 people – even though the lake water may be polluted by a neighbouring municipality. And there is no firmnesse in a municipality which totally bans residential development because people will insist on having children which require educating. I leave it to you as architects, however, to answer individually the question whether the development of your city, town, village or township has been satisfactory to you as architects since the building boom began.

To make satisfactory human habitation, be it a building or a city, requires a number of essentials, and the first of them is money. Are we poor in Ontario? No. There is plenty of private money, but not enough public money. We have read of the lack of swimming pools in Toronto. In one Zurich park they have seven, one for high diving, one for racing, one for learning to swim, one for paddling, one for horsing around in. How do they get money? The per capita expenditure in Toronto for civic purposes in 1953 was $119.27 of which over $87.00 came from property taxes. In Zurich, the per capita expenditure in 1951 was $269 for civic purposes. In the same city, the expenditure in 1951 on the two Building Departments alone was $20 per capita.

In Canada, our prime need is to harness the waters, tame the wilderness, destroy distance and open up the riches of the earth. We are still the frontier. The money and enterprise we have has first call in these fields. Beauty in buildings and urban convenience must take second place to them. Nevertheless, these things matter. Is the Ontario citizen so unconscious of them that he will not pay any more taxes to enjoy them?

In my opinion, the Ontario citizen is prepared to pay for these things, but the tax system under which money is raised for them, and for the operation of municipal government, (placing the burden where, and how, it does) cannot be pushed further with justice. New ways of raising money for municipalities must be arranged.

I have a friend who bought 100 acres and a farm house for $19,000 a short time ago. He put $5,000 down. The other day I believe he got $150,000 cash because the city began to grow out to him. Up till that day, he was paying the same taxes on his farm as a moderate sized house on an 80′ lot. When his 100 acres sprouts its little boxes, the municipality will need about $200,000 capital for schools alone. Is there any reason why it should not ask of him a capital gains tax on land of 25% or over 40%?

We all of us have motor cars, the hell machines that have multiplied the expenses of cities out of all belief, the needers of 600 sq. feet of concrete at 30 mph to carry their average load of 1.7 persons, the blighters of property values, the murderers of urbanity. I have two of these machines for which I pay the Ontario Government the immense sum of $15 a year in taxes, and, yet, every time I come to town I become ulcerous in blame of the city Planning Commissioners and the Board of Control for not building me a depressed limited access freeway.

The economic scheme under which we try to get urban beauty and convenience is unsound. Municipalities have not the money.

The second essential to urban beauty and convenience is good Provincial legislation for municipalities. In Ontario, the main body of legislation affecting municipalities was conceived in principle, and much of it was written in detail before the universal ownership of a motor car revolutionized the method of urban growth and maintenance. We have a post motor car Planning Act, and we have sections of an antique Municipal Act which gives broad powers over land use and buildings. But, if we try to use them fully, we produce obvious injustices or anomalies due to the inadequacies of other legislation.

In my municipality, we cannot stop a car going 50 miles an hour on a street of 70′ lots (with 34 foot houses 100% built up on both sides) because, in the opinion of the Municipal Act, we are rural, and, in the opinion of the Highway Traffic Act, the street is not 50% built up. Yet, we could legislate that all the houses on that street should be Tudor with pink doors and contain three families each.

We can, legally, stop the growth of Toronto at a specific line, enforce agricultural green belts, maintain Ontario's best orchard land, and lay out satellite towns by simple zoning. But, having no way to do it with economic fairness to those who elect us, we plan for a great amorphous urban sprawl, and are prepared to sacrifice every tenet of good planning to get industrial assessment.

The legislation under which we must try to build beauty and convenience is out of date.

The third essential is a good civic organization to ensure good civic design and land use. Yesterday, I telephoned the city architect of a great Canadian city which shall be nameless, and asked him how the activities of his department were coordinated with those of the Planning Board's staff. He said, and I quote his words exactly, "I do not know of any activity in relation to them". After some thought he added, "They tell us where they hope to see new streets built, and we try to stop issuing building permits there, but, of course, we can't do it as an owner can always get a mandamus."

Our civic organization is usually weak due probably to lack of money and good legislation as much as to incompetence, but it is still weak and it is still an essential if we want urbanity.

The last essential to a good city is public support of town planning. The Federal Government, even though Liberal, has recognized the need of this, and supports the withering Community Planning Association of Canada. How many in this room are members? How many have actively worked for it? How many architects have any skill in the field of town planning? I know there are architects on the committee for University Avenue in Toronto, and there

(continued on opposite page)

CALENDAR OF EVENTS

86th Convention of the American Institute of Architects, Statler Hotel, Boston, Mass., June 15th to 19th, 1954.

ONTARIO

With the drab city winter receding and pleasant weather ahead, it is a wrench to think about the latest walls being erected in Toronto to shut out the sun.

The wall is designed to keep the man in the street out and he knows it. He can look with pleasure on windows, balconies, canopies and sculpture but a wall stripped of these has lost its interest.

The bulk of the big new office buildings being completed, that mark this city's pride in its fantastic new wealth and well-being, look as if they have been built to resist a siege in a depression that they presume will follow. Small barred windows and heavily embossed doors are there to keep the starving mob out, with high parapet walls and entablatures to shelter the defendants on the ramparts. Gone are the graceful cornices and colonnades that provided shelter for the pigeons and so suited an age of ease and elegance.

These are the buildings of modern Europe fifty years ago. They are contemporary inasmuch as Russian communist building is contemporary. One architect boasts that his walls are two feet thick; another that not a vestige of the outside air can get in; a third that his fluorescent light is better than daylight. Perhaps the next great step forward will be a revival of mediaeval architecture with slits to provide space for thermostats and daylight reading meters.

Turning to the lighter side, there are, of course, a few daring new modern buildings going up that are cautiously following the developments of twenty years ago in Europe and the States. Our own new OAA building is taking shape and soon will be completed. Some of the older members, of course, will never know whether it has been completed, since the building is so organic (endless or taut whichever you prefer) that it looks as though it might sprout at any moment. To conclude, I feel that nothing can come of our collective or individual efforts if this mutual admiration society continues in which the man who gets the biggest commission is regarded as the finest architect, and where speed on the draughting board is rated higher than perfection in detail.

Peter Dickinson

ARCHITECTURE AND THE STATE

are architects at the elbow of the building inspector in Forest Hill Village, and there are architects holding onto the Greber plan in Ottawa and looking awfully worthy, but how many of these are doing it for the main purpose of getting a job?

I attended a Toronto Chapter meeting of the OAA a year or so ago, and emerged in some odd way chairman of a committee to bring pressure to bear on the city architect of Toronto to limit his activities to inspecting elevators, and public lavatories (if any), to tearing down old sheds, and seeing that inflammable liquids did not inflame. In my opinion, the city architect should be a dominating influence on the growth and redevelopment of Toronto. The architectural profession is officially out to prevent him from assuming this role. If the architectural profession will not support either the body or the man which can best provide leadership to the public in bettering civic design, is it likely that civic design in Toronto will be anything more than a controller's yen in the new civic square for a central monument to something or somebody, preferably dead, and six marble seats for rubby dubs to sit on?

CONTRIBUTORS TO THIS ISSUE

Anthony Adamson was born in 1906 in the slums of Toronto with a spoon in his mouth, silver plated but crested. Educated at an exclusive private school for girls in Toronto and, after that, in all the best seats of learning in Europe. Graduated from Cambridge in what was thought to be architecture in 1927. Got M.A. by paying $33. Practised architecture ineffectively and retired to a number of good sanatoria for seven years. Returned to Toronto and became a town planning consultant and a professor – not being able to make a living in any other way. Went to Europe in 1952 on a U.N. fellowship to study town planning and municipal affairs. At present Reeve of the Township of Toronto.

Arthur G. Keith graduated from the University of Toronto School of Architecture in 1937. He was with several Toronto offices and, later, was associated with L. H. Smart in Bermuda. During the war, Mr Keith spent five years overseas with the Royal Canadian Engineers and is now 2 I/C of the Reserve Regiment. In 1945, he was employed by the Toronto Transportation Commission as Chief Architect, and was largely responsible for the architectural design of the Subway. Mr Keith is now chief architect and a senior associate with the consulting engineering firm, Margison Babcock and Associates Limited.

ACKNOWLEDGEMENT

The preparation of material for this issue was a particularly onerous task which **Mr Arthur Keith** undertook willingly and gladly. The Editorial Board wishes to express its great appreciation.

FUTURE ISSUES

June	Industrial
July	Landscaping and the University City of Mexico
August	Houses
September	Schools
October	Hospitals

Facts about Glass by Pilkington

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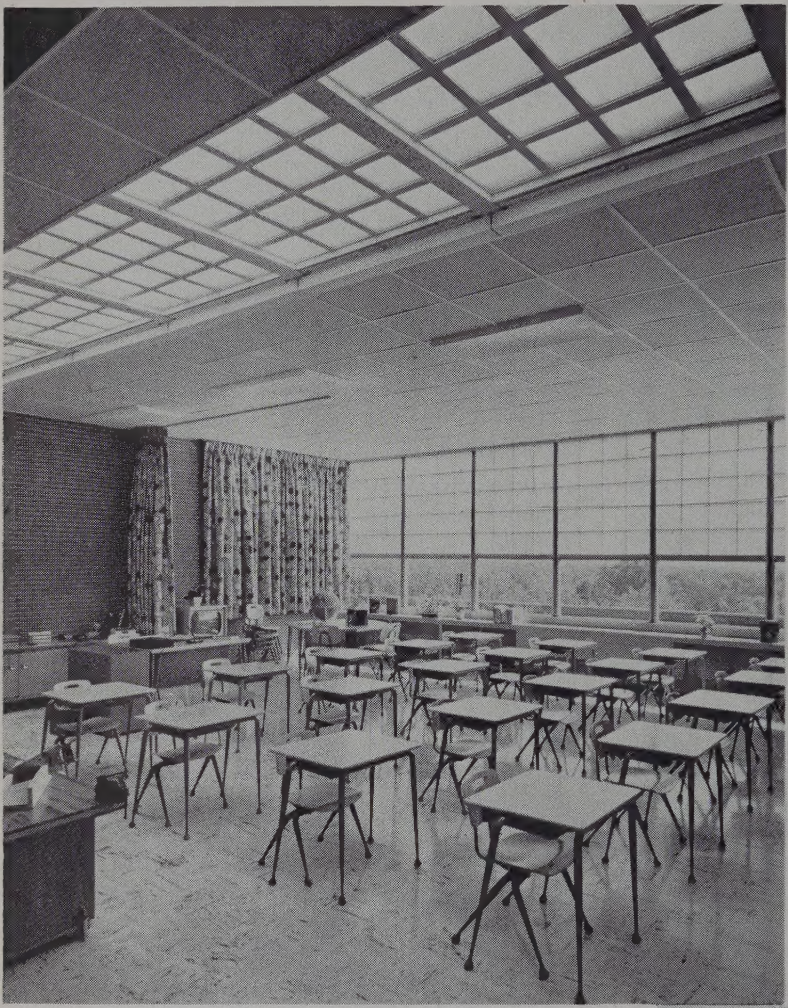
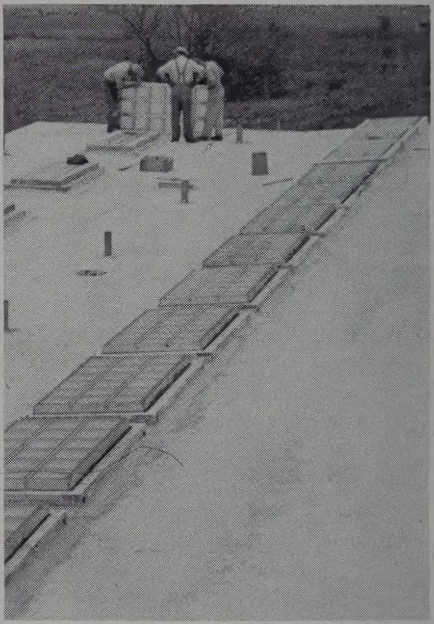
TOPLITE





Toplite is especially adapted to school design. Regardless of the depth of classroom it is possible to provide approved illumination levels over the whole room area.

The typical school installation illustrated above shows an installation above a corridor in the foreground and Toplite panels over classrooms at left.

DAYLIGHT FROM ABOVE

Toplite Roof Panels provide a new approach to lighting. Factory fabricated, they are made up of an insulated aluminum grid into which hollow glass units are set. The result is steady and even illumination . . . without glare or harsh contrasts. Low Autumn and Winter sun as well as cool northern light are freely transmitted. Yet the hot glare of the Summer sun is deflected and modified to a cool, even light.

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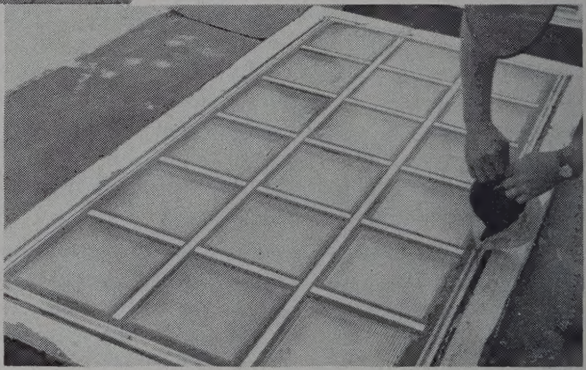

Toplite panels are set on prepared concrete leaving an expansion space which is caulked with oakum and the joint sealed by pouring in an approved compound. Standard methods installing an asphaltic compound and fabric membrane complete the job.

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